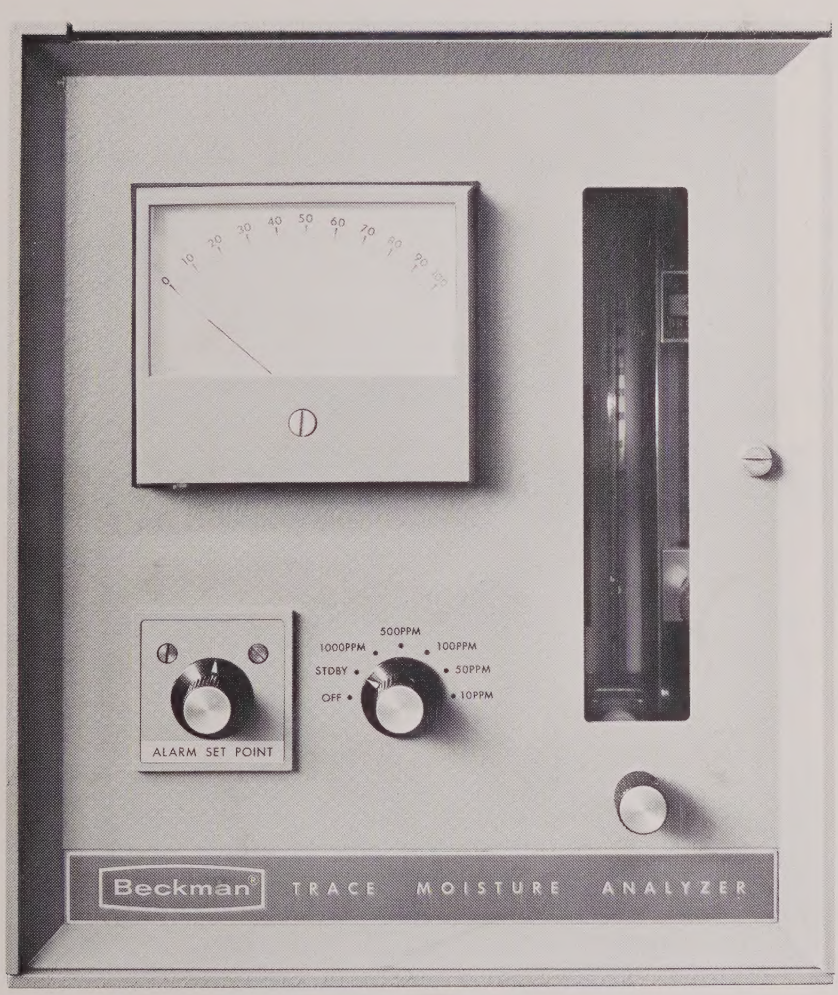
Beckman

MODEL 340



TRACE MOISTURE ANALYZERS

STABRO LABORATORIES, INC.
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DOCUMENT CONTROL ADMINISTRATOR

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MODEL 340 TRACE MOISTURE ANALYZERS

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SPECIFICATIONS	Catalog Number	Sample System Materials	Case Configuration	Power Requirements
For Non-Portable *or* Semi-Portable Use	Beckman 193000 Panel-Mounted/Semi-Portable Trace Moisture Analyzer	316 stainless steel, Viton, Teflon.	One panel-mounted, purgeable case. Detachable carrying handle provided for semi-portable bench use.	
	Beckman 193001 Panel-Mounted/Semi-Portable Trace Moisture Analyzer	Brass, aluminum, neoprene, Buna-N, stainless steel.		
Non-Portable Analyzers	Beckman 193002 Remote-Control Trace Moisture Analyzer	316 stainless steel, Viton, Teflon.	Separate detector and control modules, each with panel-mounted purgeable case.	107 to 127 volts, 50/60 Hz ±0.1 Hz, 80 watts maximum.
	Beckman 193003 Remote-Control Trace Moisture Analyzer	Brass, aluminum, neoprene, Buna-N, stainless steel.		
	Beckman 193004 Explosion-Proof Trace Moisture Analyzer	316 stainless steel, Viton, Teflon.	Detector Module: Class I, Group D, Division 1. Control Module: Purgeable Case.	
Portable Analyzers	Beckman 193005 Portable A.C. Trace Moisture Analyzer	Brass, aluminum, neoprene, Buna-N, stainless steel.	Portable, with carrying handle.	107 to 127 volts, 50/60 Hz ±0.1 Hz, 20 watts maximum.
	Beckman 193006 Portable D.C. Trace Moisture Analyzer	Brass, aluminum, neoprene, Buna-N, stainless steel.	Portable with carrying handle.	+15 volts/−15 volts d.c., from self-contained battery pack.

RANGES
0 to 10, 0 to 50, 0 to 100, 0 to 500, 0 to 1000 parts-per-million H_2O by volume.

ACCURACY
±5% of fullscale (not applicable to 0 to 10 ppm range or to hydrogen sample stream containing less than 25 ppm H_2O).

SENSITIVITY
Less than 1 ppm.

SAMPLE FLOW RATE
100 cc/minute.

BYPASS FLOW
Adjustable bypass flow of 0 to 2 cubic feet per hour is standard in non-portable and semi-portable instruments, and is obtainable for portable instruments through use of optional flowmeter accessory.

SAMPLE PRESSURE
Standard range 10 to 100 psig. Low-Pressure Sampling Accessory provides range of 10 inches mercury vacuum to + 10 psig. High-Pressure Sampling Accessory provides range of 1000 to 6000 psig.

SAMPLE TEMPERATURE
32°F to 176°F (0°C to 80°C).

AMBIENT TEMPERATURE
0°F to 120°F.

SAMPLE INLET AND OUTLET CONNECTIONS
⅛-inch Swagelok bulkhead fittings.

RECORDER OUTPUT
Potentiometric Output: All analyzers provide selectable output of 0 to 10 mv, 0 to 100 mv, 0 to 1 volt, or 0 to 5 volts.
Current Output: Available as a plug-in option for a.c. analyzers only. Circuit board provides 4 selectable outputs.

Output (ma)	Maximum Permissible Load (ohms)
0 to 5	800
1 to 5	8000
4 to 20	2000
10 to 50	700

ALARM FUNCTION (OPTIONAL FEATURE, FOR NON-PORTABLE AND SEMI-PORTABLE ANALYZERS ONLY)
Set Point Accuracy: ±½ of fullscale, or 25 mv.
Repeatability: 1% of fullscale.
Set Point Range: 0 to 100% or 0 to 5 volts d.c., displayed on front-panel meter.
Hysteresis: 2% of fullscale is standard, adjustable by changing resistor on circuit board.
Output: (1) Isolated (2) 190 volts d.c. or a.c. maximum, (3) 1.5 amperes a.c. or d.c. maximum.

SECTION ONE INTRODUCTION

The Beckman Model 340 Trace Moisture Analyzer automatically and continuously measures water-vapor concentrations, up to a maximum of 1000 ppm, in a gaseous sample stream. The determination is based on the simultaneous absorption and electrolysis of water. The instrument has a wide range of applications, in monitoring many gases used in manufacturing processes. (Suitable and unsuitable sample gases are listed in Paragraph 1.2.)

Permissible sample pressure range for the standard instrument is 10 to 100 psig. Optional sampling accessories permit monitoring gas streams at atmospheric, sub-atmospheric, or elevated pressures.

The analyzer provides direct readout on a front-panel meter and a selectable output for an accessory potentiometric recorder. With all a.c.-operated versions of the analyzer, a selectable output for a current-type recorder is obtainable through use of an optional plug-in circuit board.

The electronic circuitry utilizes plug-in printed-circuit boards with solid-state components. This feature facilitates servicing, and permits the inclusion of various options, such as alarm features, by the addition of the appropriate boards.

1.1 INSTRUMENT CONFIGURATIONS

The model 340 Analyzer is made in the following configurations:

1. Panel-Mounted/Semi-Portable Analyzer, Figure 1-1, with detector, electronic circuitry, and operating controls housed in a *single* purgeable case. Available with internal flow system of either stainless steel (193000 Analyzer) or brass (193001 Analyzer). Provided in the shipping kit is a carrying handle which may be attached to the top of the analyzer case, to adapt it to semi-portable, bench-top use.
2. Remote-Control Analyzer, Figure 1-2, consisting of separate, electrically-interconnected, detector and control sections housed in two panel-mounted purgeable cases of identical size. Available with internal flow system of either stainless steel (193002 Analyzer) or brass (193003 Analyzer).
3. The 193004 Explosion-Proof Analyzer, Figure 1-3. Designed for use in the chemical, petrochemical, and petroleum industries, in applications where the sample stream contains flammable gases, or where explosive vapors may be present at the installation site. Control section is identical to that of the Remote-Control Analyzer. Detector section is contained in an explosion-proof housing that meets the requirements for operation under the hazardous conditions specified for Class I, Group D, Division 1, of the National Electrical Code. Flow system is of stainless steel.
4. Portable Analyzer, Figure 1-4. Available for operation on either 115 volts, 50/60 Hz (193005 Analyzer) or +15 volts/—15 volts d.c. from a self-contained battery pack (193006 Analyzer).

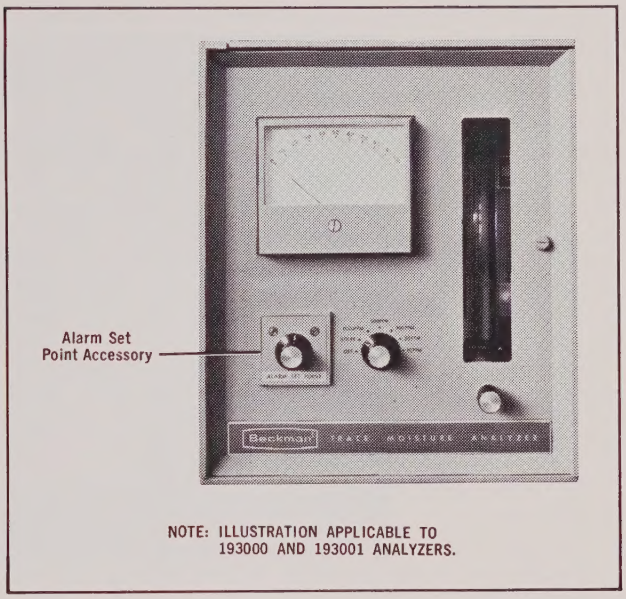


Figure 1-1. Panel-Mounted/Semi-Portable Trace Moisture Analyzer

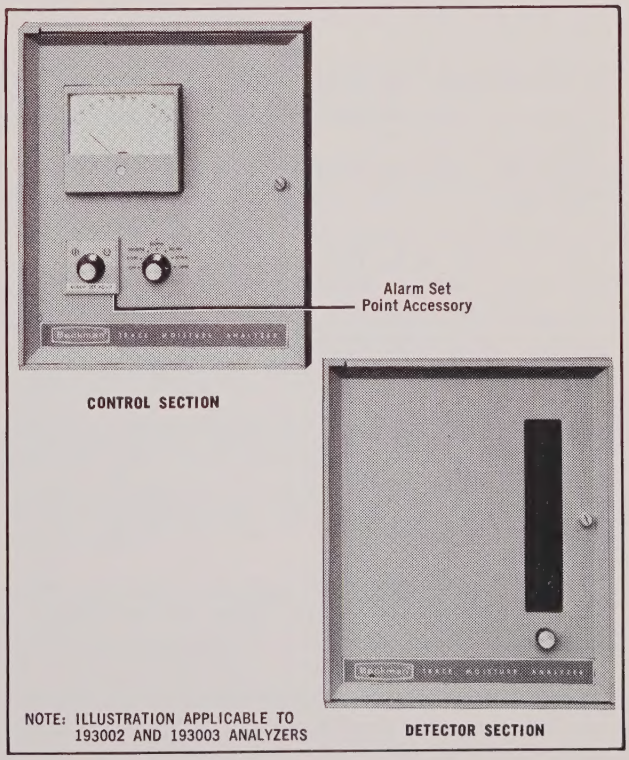


Figure 1-2. Remote-Control Trace Moisture Analyzer

Except where specifically stated otherwise, information in this manual applies to all versions of the instrument.

1.2 SAMPLE GASES

Determination of whether a sample stream of a particular composition is suitable for monitoring depends on its compatability with the construction materials in (a) the detector cell, and (b) the instrument flow system. In *all* instruments, the detector cell utilizes a thin film of P_2O_5 on rhodium electrodes. Depending on the intended application of a given instrument version, its internal flow system is constructed of either stainless steel (for corrosion resistance) or brass (for non-corrosive sample gases only).

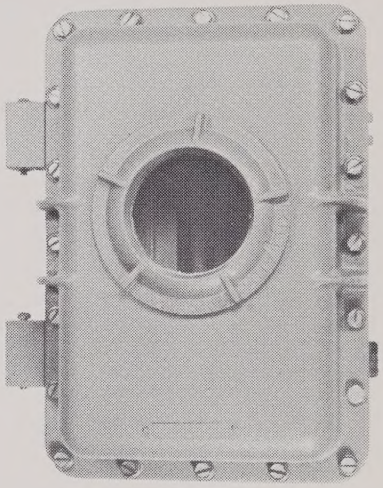
Typical suitable and unsuitable sample gases are listed in Paragraphs 1.2.1 and 1.2.2, respectively.

1.2.1 SUITABLE SAMPLE GASES

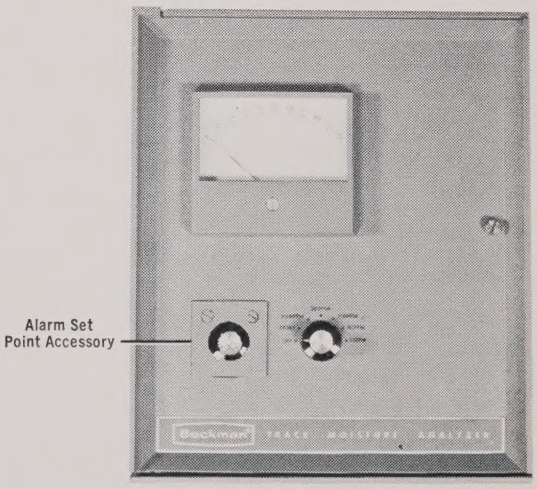
1. Elemental Gases: argon, helium, neon, nitrogen, oxygen, hydrogen.
2. Inorganic Gaseous Mixtures and Compounds: air, carbon dioxide, carbon monoxide, sulphur dioxide, sulphur hexafluoride.
3. Organic Gaseous Compounds: butane, ethane, ethylene, freon 12, methane, propane, propylene (with a maximum of 100 ppm H_20), halogenated hydrocarbons.

1.2.2 UNSUITABLE SAMPLE GASES

1. Gases that react with P_2O_5 to produce additional water. Example: alcohols, HF.
2. Gases that react with construction materials of the instrument.
3. Gases that react with P_2O_5 to alter required absorption characteristics of the P_2O_5 film.
   Examples: ammonia, amines.
   Satisfactory monitoring of sample streams containing *trace* amounts of ammonia is made possible through use of the 75757W HCl Injection Kit. This device neutralizes the ammonia by injecting a small flow of anhydrous hydrogen chloride into the sample. Items supplied include a cylinder regulator, filter, capillary, mixing chamber, and tubing fittings.
4. Gases that polymerize to form a solid or liquid phase (they gradually desensitize the detector cell by coating or clogging).
   Example: Unsaturated hydrocarbons — alkynes, alkadienes and alkenes (higher than propylene).
5. Gases that contain particulate solid or liquid materials such as dust and dirt found in furnace atmosphere gases. These must be avoided or filtered out upstream; oil mist or dust from some types of dryers can clog the detector cell or desensitize the P_2O_5 film by forming a layer over the film.



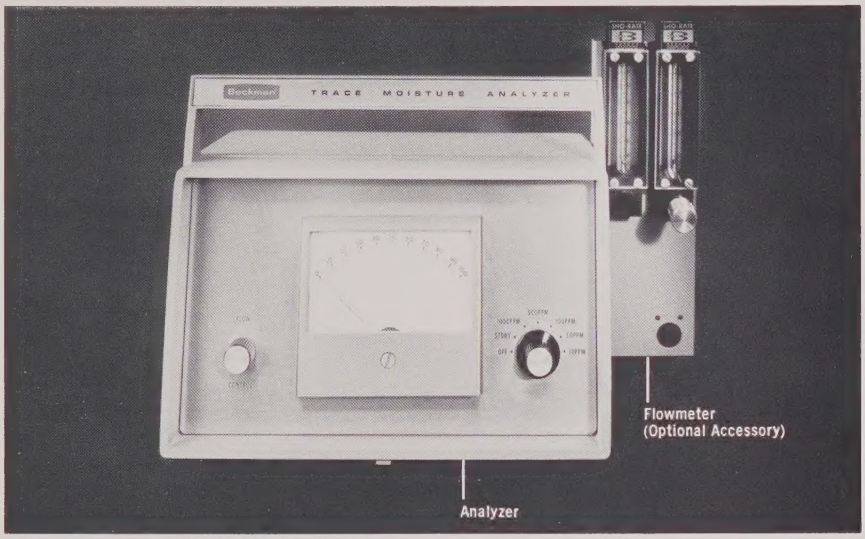
DETECTOR SECTION



CONTROL SECTION

NOTE: ILLUSTRATION APPLICABLE TO 193004 ANALYZER.

Figure 1-3. Explosion-Proof Trace Moisture Analyzer



NOTE: ILLUSTRATION APPLICABLE TO
193005 AND 193006 ANALYZERS.

Figure 1-4. Portable Trace Moisture Analyzer and Flowmeter Accessory

SECTION TWO INSTALLATION

Install the instrument as explained in the following paragraphs.

2.1 FACILITY PREPARATION

Paragraphs 2.1.1 through 2.1.4 provide information that may be required prior to installation.

2.1.1 OUTLINE AND MOUNTING DIMENSIONS

For significant dimensions of the instrument, refer to the appropriate Figure(s) listed in the following table.

Instrument	Figure(s)
193000 and 193001 Panel-Mounted/Semi-Portable Analyzers	Figure 2-1
193002 and 193003 Remote-Control Analyzers	Figure 2-1 (Case dimensions for detector and control sections are identical.)
193004 Explosion-Proof Analyzer	Control Section: Figure 2-1 Detector Section: Figure 2-2
193005 and 193006 Portable Analyzers	Figure 2-3

2.1.2 INTERCONNECTION DIAGRAM (REMOTE-CONTROL AND EXPLOSION-PROOF ANALYZERS ONLY)

Figure 2-4 shows electrical interconnection for 193002 and 193003 Remote-Control Analyzers, and the 193004 Explosion-Proof Analyzer.

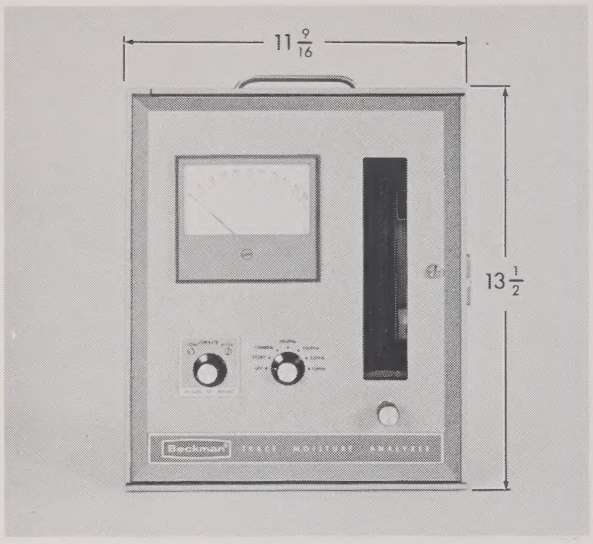
2.1.3 LOCATION

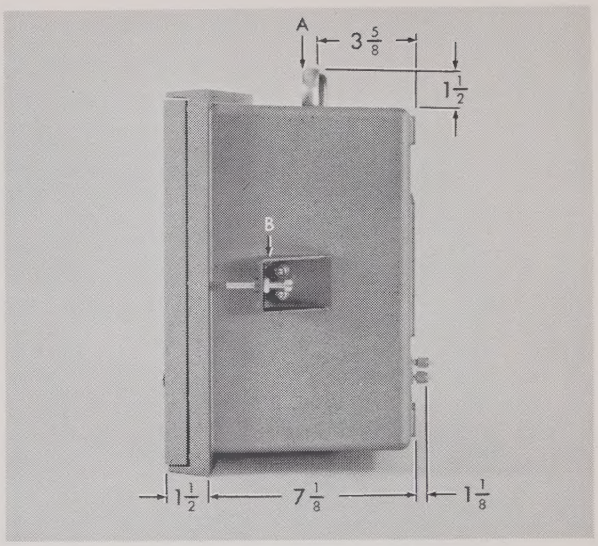
Ambient temperature range for all analyzers is 0°F to 120°F. Additional requirements, specific to the various analyzer configurations, are given in the following:

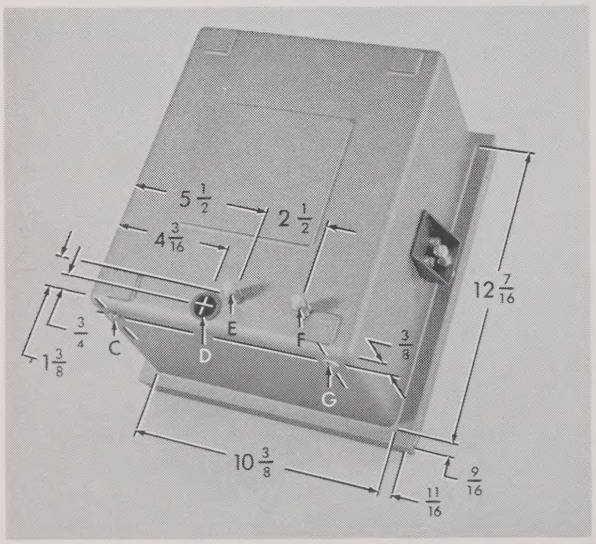
193000 and 193001 Panel Mounted/Semi-Portable Analyzers
Install in a clean area, not subject to excessive vibration or extreme temperature variations. Preferably, the instrument should be mounted near the sample stream, to minimize transport time.

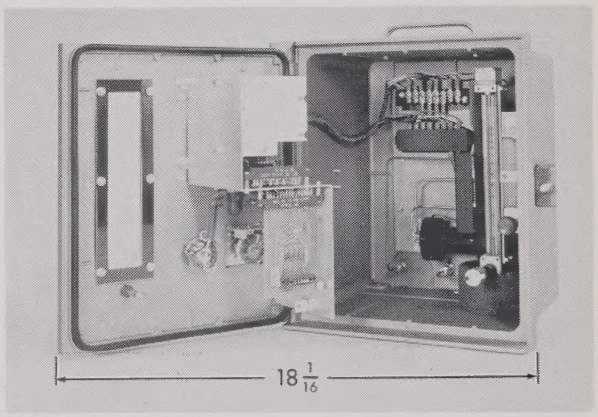
193002 and 193003 Remote-Control Analyzers
If possible, mount detector section near sample stream to minimize transport time.

Control section may be mounted at any desired distance, up to a maximum of 1000 feet, from the detector. The two sections are interconnected by a Beckman 835495 Cable, supplied in the length ordered.





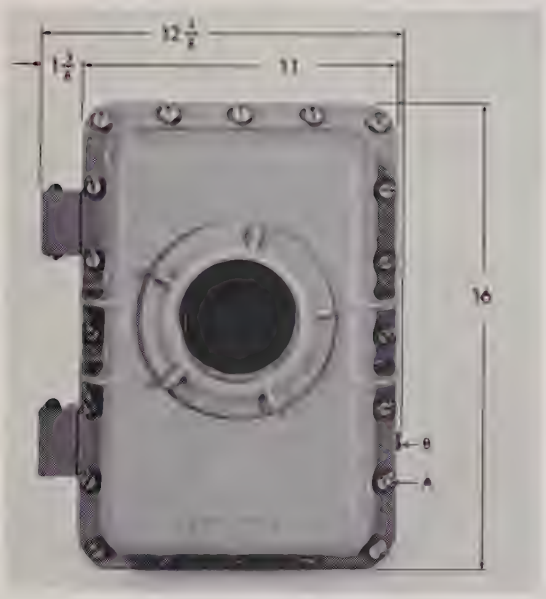




A Detachable handle for semiportable use. Supplied by Beckman.
B Bracket & hardware for panel mounting. Supplied by Beckman.
C Outlet 1/4-18 NPT (for purge) located laterally (horizontally) 1 1/2" from bezel outside edge.
D 7/8 dia for 1/2 conduit fitting. Power cable supplied by customer.
E Inlet (Swagelock bulkhead fitting) for 1/8 O.D. Tube. Not used on 193004 Controller
F Outlet (Swagelock bulkhead fitting) for 1/8 O.D. tube. Not used on 193004 Controller
G Inlet 1/4-18 NPT (for purge) located laterally (horizontally) 1 3/4" from bezel outside edge.

1 Allow 12" for door swing.
2 Allow 1" to hinge side of case for opening door.
3 Recommended panel cutout 10 9/16 wide x 12 5/8 high x 1 1/2 max. panel thckness.
4 Allow 1" above case for door removal.
5 120 VAC 50/60 Hz
6 Mount indoors or outdoors (weatherproof.)
7 Weight approx. 25 lbs.
8 All dimensions are in inches ±1/16.
9 On 193004 Controller, outlet G and inlet C for purge not recommended.

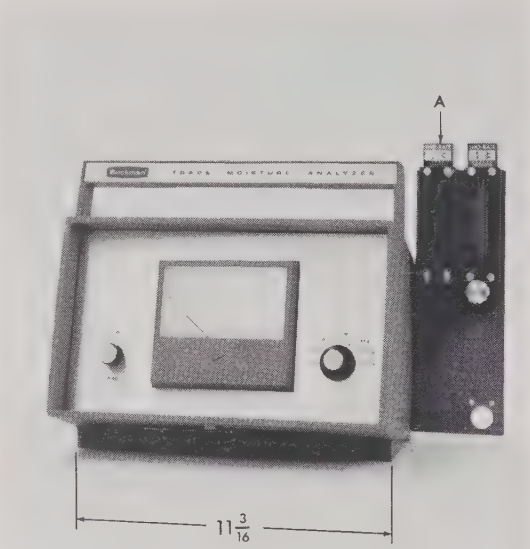
Figure 2-1. Outline and Mounting Dimensions for Panel-Mounted/Semi-Portable and Remote-Control Analyzers, and Control Module of Explosion-Proof Analyzer

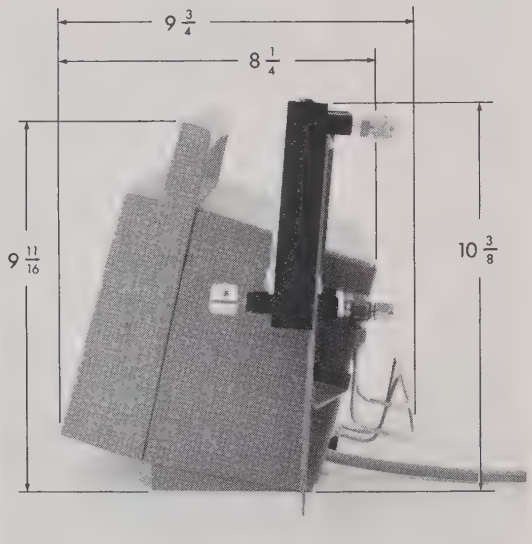


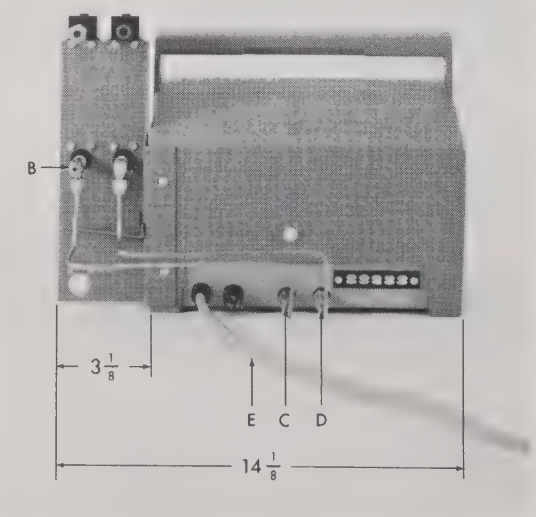
A 3/8-20 x 1 3/4 bolt
B Flowmeter fully open
C Inlet (Swagelock Bulkhead Fitting for 1/8 O.D. Stainless Steel Tube)
D Outlet (Swagelock Bulkhead Fitting for 1/8 O.D. Stainless Steel Tube)
E 1/2-14 for 1/2 Conduit Fitting (power)
F Flow Control Knob
G Slotted for 3/8 dia. mtg. screws
H Door swing 15 11/16 from mounting surface

1. Mount indoors only. (Not water tight.)
2. Weight approx. 45 lbs.
3. 120 VAC 50/60 Hz
4. All dimensions are in inches ±1/16

Figure 2-2. Outline and Mounting Dimensions for Detector Module of Explosion- Proof Analyzer







A Flowmeter Assy
B Inlet (Swagelock Tee Fitting for 1/8 O.D. Stainless Steel Tube)
C Inlet (Swagelock Bulkhead Fitting for 1/8 O.D. Stainless Steel Tube)
D Outlet (Swagelock Bulkhead Fitting for 1/8 O.D. Copper Tube)
E Power Cord UL type SST, 6 ft. long, 2 pole, 3 wire grounding type supplied

1. Weight Approx. 17 Lbs.
2. 120 VAC 50/60 Hz or battery powered
3. All dimensions are in inches ±1/16

Figure 2-3. Outline and Mounting Dimensions for Portable Analyzers

193004 Explosion-Proof Analyzer

Detector Section: Criteria for installation site are proximity to sample point, protection from environment, and accessibility for servicing. Protect the unit adequately against shock and extreme vibration.

Control Section: Principal criterion for the installation site is that it must be outside the hazardous area. Hazardous locations are defined in Article 500 of the National Electrical Code. An additional consideration is convenience in taking readings and servicing the unit.

193005 and 193006 Portable Analyzers

Normally, these instruments are used on a desk or bench.

2.1.4 UTILITY SPECIFICATIONS

Electrical power requirements are listed in the following table.

193000 and 193001 Panel-Mounted/Semi-Portable Analyzers 193002 and 193003 Remote-Control Analyzers 193004 Explosion-Proof Analyzer	107 to 127 volts, 50/60 Hz, 80 watts.
193005 Portable Analyzer	107 to 127 volts, 50/60 Hz, 20 watts.
193006 Portable Analyzer	+15 volts/—15 volts d.c. from self-contained battery pack.

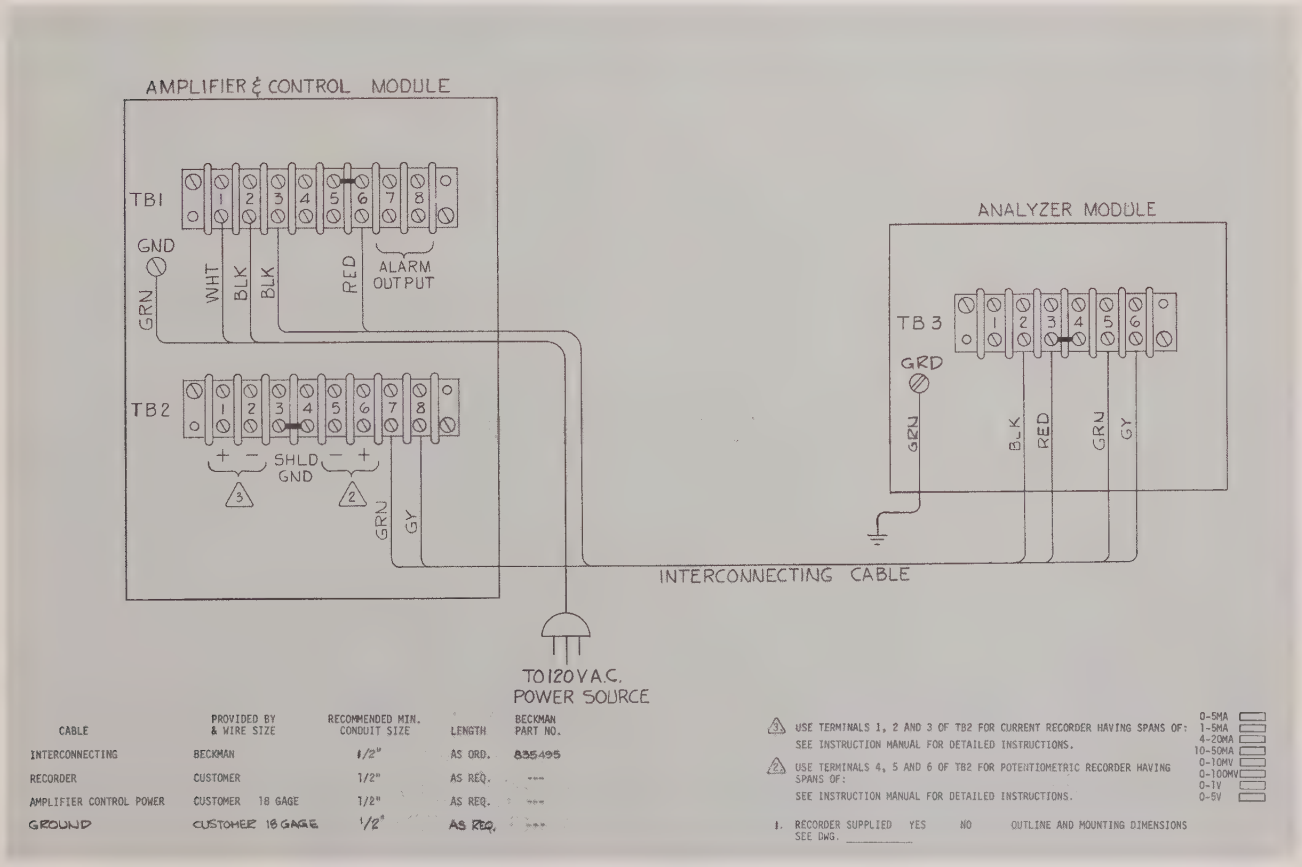

AMPLIFIER & CONTROL MODULE
TB1
GND
GRN
WHT
BLK
BLK
RED
ALARM OUTPUT
TB2
SHLD GND
GRN
GY
ANALYZER MODULE
TB3
GRD
GRN
BLK
RED
GRN
GY
INTERCONNECTING CABLE
TO 120 V A.C. POWER SOURCE
CABLE | PROVIDED BY & WIRE SIZE | RECOMMENDED MIN. CONDUIT SIZE | LENGTH | BECKMAN PART NO.
INTERCONNECTING | BECKMAN | 1/2" | AS ORD. | 835495
RECORDER | CUSTOMER | 1/2" | AS REQ. | ---
AMPLIFIER CONTROL POWER | CUSTOMER 18 GAGE | 1/2" | AS REQ. | ---
GROUND | CUSTOMER 18 GAGE | 1/2" | AS REQ. | ---
3 USE TERMINALS 1, 2 AND 3 OF TB2 FOR CURRENT RECORDER HAVING SPANS OF: 0-5MA 1-5MA 4-20MA 10-50MA
SEE INSTRUCTION MANUAL FOR DETAILED INSTRUCTIONS.
2 USE TERMINALS 4, 5 AND 6 OF TB2 FOR POTENTIOMETRIC RECORDER HAVING SPANS OF: 0-10MV 0-100MV 0-1V 0-5V
SEE INSTRUCTION MANUAL FOR DETAILED INSTRUCTIONS.
1. RECORDER SUPPLIED YES NO OUTLINE AND MOUNTING DIMENSIONS SEE DWG. _____

Figure 2-4. Interconnection Diagram (Remote-Control and Explosion-Proof Analyzers Only)

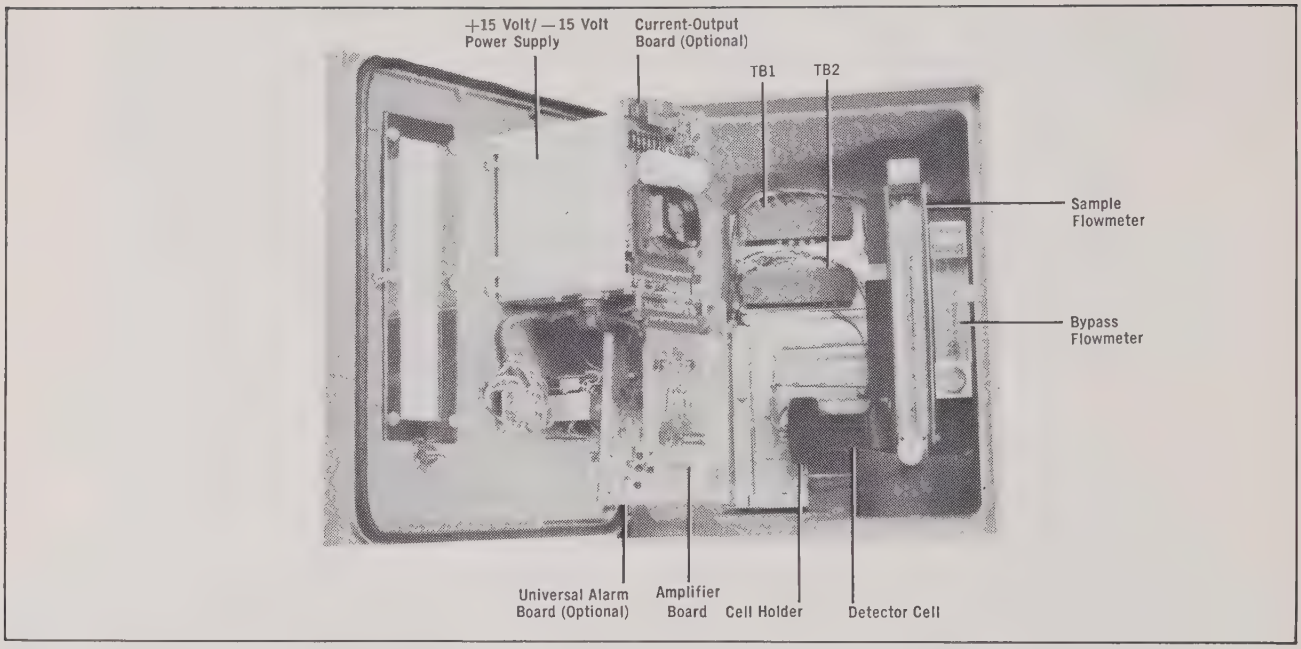


Figure 2-5. Interior of Panel-Mounted/Semi-Portable Analyzer

2.2 UNPACKING

Unpack instrument carefully. For a list of items supplied in the shipping kit, refer to Section Ten.

2.3 ELECTRICAL CONNECTIONS

Depending on the particular options used, electrical setup may entail insertion of various selector plugs into appropriate positions in the associated circuit boards. Locations of circuit boards and other components within the several analyzer configurations are shown in Figures 2-5 through 2-9. Locations of selector plugs on the individual circuit boards are shown in Figure 2-10.

Make electrical connections in the following sequence:

1. If a recorder is to be used, select the particular output required and make the appropriate cable connections as explained in Paragraph 2.3.1 (potentiometric recorder) or Paragraph 2.3.2 (current recorder). All analyzers provide potentiometric output. Current output is obtainable from *a.c.-operated instruments only*, through use of the optional current-output circuit board.
2. If an alarm system is to be used, select the desired function and connect the output as explained in Paragraph 2.3.3. Alarm output is obtainable from *non-portable and semi-portable instruments only*, through use of the Alarm Set Point Accessory and Universal Alarm Board in combination.
3. With Remote-Control or Explosion-Proof Analyzer, interconnect detector and control modules per Paragraph 2.3.4.
4. Supply electrical power to analyzer per Paragraph 2.3.5.

2.3.1 OUTPUT SELECTION AND CABLE CONNECTIONS FOR POTENTIOMETRIC RECORDER

To use a potentiometric recorder:

1. At multi-pin receptacle on amplifier circuit board, A of Figure 2-10, insert two shorting plugs as follows:
   a. Insert plug between pair of pins designated NO in area marked CUR. BD. YES/NO. (This connection routes amplifier-output signal through voltage divider, as explained in Paragraph 7.3.2.)
   b. Insert plug between pair of pins with labeled designation that corresponds to desired output. Options are 10 mv, 100 mv, 1 volt, and 5 volts.
2. Connect appropriate leads of shielded recorder cable to POT. REC. "+" and "—" terminals, and SHLD terminal, on output terminal strip. For location of terminal strip, refer to appropriate illustration of Figures 2-5 through 2-9.
3. Connect recorder end of output cable as required for the particular recorder span:
   a. For recorder with span of 10 mv, 100 mv, 1 volt, or 5 volts, connect cable directly to recorder input terminals, making sure polarity is correct.

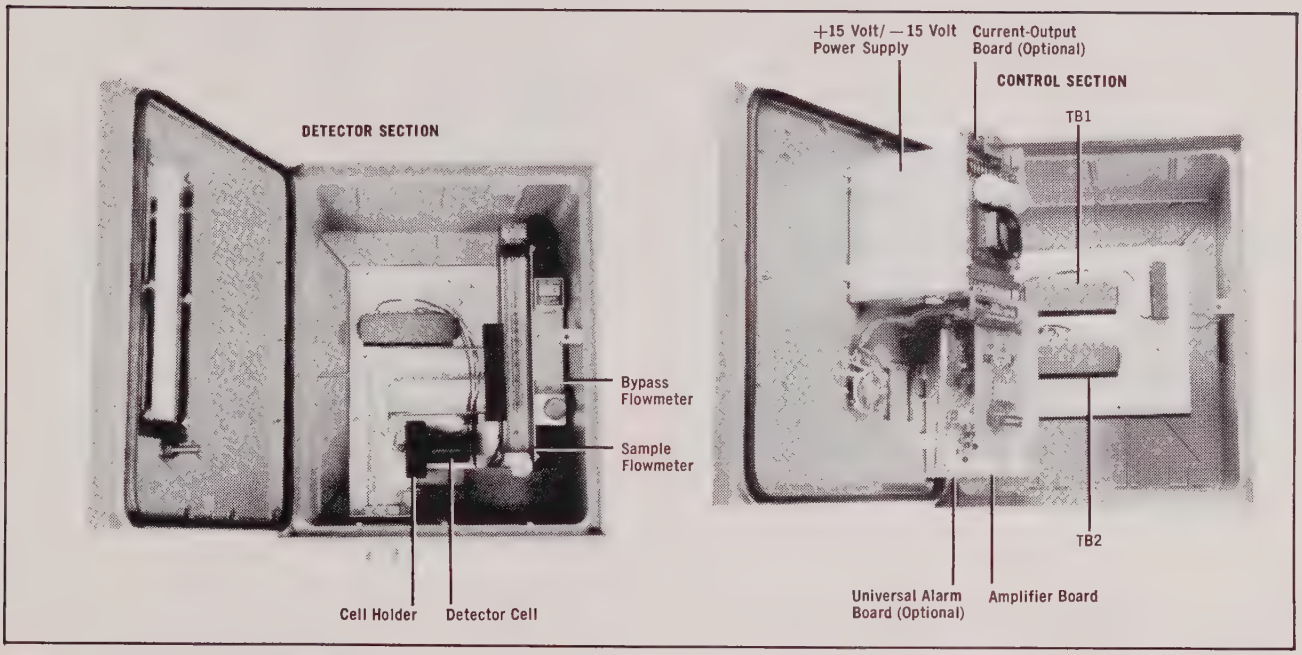


Figure 2-6. Interior of Remote-Control Analyzer

b. For recorder with an intermediate span, i.e., between the specified values, connect cable to recorder via a suitable external voltage divider, as shown in Figure 2-11.

2.3.2 OUTPUT SELECTION AND CABLE CONNECTIONS FOR CURRENT RECORDER (A.C. ANALYZERS ONLY)

To use a current recorder:

1. Connect appropriate leads of shielded recorder cable to CUR. REC. "+" and "—" terminals, and SHLD terminal, on output terminal strip. For location of terminal strip, refer to appropriate illustration of Figures 2-5 through 2-8.
2. Connect recorder end of output cable to recorder input terminals, making sure polarity is correct.

NOTE

Combined resistance of recorder and associated interconnection cable must not exceed value in following table.

Recorder Span (ma)	Maximum Permissible Load (ohms)
0 to 5	800
1 to 5	8000
4 to 20	2000
10 to 50	700

3. At multi-pin receptacle on amplifier circuit board, A of Figure 2-10, insert shorting plug between pair of pins designated YES in area marked CUR. BD. YES/NO. (This connection routes amplifier-output signal through current-output board.)
4. Verify that current-output board is properly in place in its connector.
5. On current-output board, B of Figure 2-10, insert two plugs in their receptacle, in the positions appropriate to the desired recorder:
   a. Live-Zero/Dead-Zero Selector: For 0 to 5 ma recorder, orient plug so its arrow points to end of receptacle labeled DEAD. For 1 to 5, 4 to 20, or 10 to 50 ma recorder, orient plug so arrow points to end labeled LIVE.
   b. Recorder Milliampere Selector: Orient plug so that the side with the labelled designation corresponding to the desired ma current range faces outward, and covers the REC MA label on the current-output board. Sides of plug are labelled 0-5, 1-5, 4-20, and 10-50.

2.3.3 ALARM OUTPUT CONNECTION AND ALARM FUNCTION SELECTION (OPTIONAL, FOR NON-PORTABLE AND SEMI-PORTABLE ANALYZERS ONLY)

The optional Alarm Set Point Accessory and Universal Alarm Board are used in combination to provide an alarm

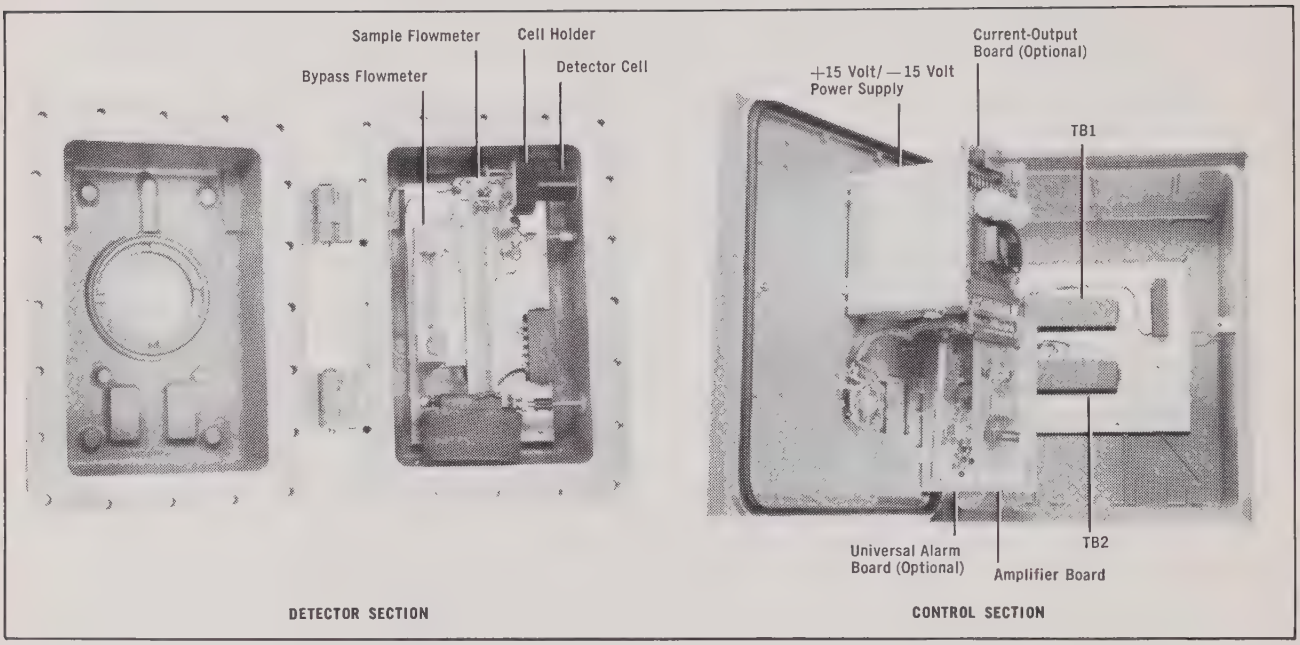


Figure 2-7. Interior of Explosion-Proof Analyzer

output that actuates an external, customer-supplied alarm and, or, process-control device whenever the water-vapor concentration of the sample stream exceeds a preselected level.

If so specified, the analyzer is factory-assembled to include the Alarm Set Point Accessory and Universal Alarm Board. Alternatively, these two items are obtainable in the form of the 630695 Alarm Kit, intended for subsequent installation in an analyzer not originally equipped with alarm function.

Setup procedure for alarm systems is described in the following steps. If internal alarm components have been installed previously in the analyzer, proceed directly to Step 4; otherwise, first perform Steps 1 through 3.

1. Mount Alarm Set Point Accessory in cutout in analyzer door. Refer to appropriate illustration of Figures 1-1 through 1-3.
2. At receptacle J5, Figure 9-2, remove shorting plug; insert plug P5 of multiconductor cable from Alarm Set Point Accessory.
3. Insert Universal Alarm Board into corresponding connector. Refer to appropriate illustration of Figures 2-5 through 2-7.
4. Connect input leads from external alarm system to ALARM OUTPUT terminals on terminal strip TB1. For location of terminal strip, refer to appropriate illustration of Figures 2-5 through 2-7.
5. At multi-pin receptacle on universal alarm board, C of Figure 2-10, insert shorting plug in the position appropriate to the desired alarm function:
   a. If ALARM OUTPUT terminals are to provide a *normally-open* circuit, insert plug into HI N.O. position. Alarm-output circuit will now *close* when water-vapor content exceeds preselected level.
   b. If ALARM OUTPUT terminals are to provide a *normally-closed* circuit (as in a fail-safe system), insert plug into HI N.C. position. Alarm-output circuit will *open* when water-vapor content exceeds preselected level.

NOTE

In Trace Moisture Analyzers, the LOW N.O. and LOW N.C. positions are normally not used.

Selection of the desired alarm set point is explained in Paragraph 3.4.

2.3.4 ELECTRICAL INTERCONNECTION FOR REMOTE-CONTROL AND EXPLOSION-PROOF ANALYZERS

Interconnect detector and control modules as shown in Figure 2-4. The Beckman 835495 Interconnection Cable is supplied, as ordered, in any desired length up to a maximum of 1000 feet.

2.3.5 ELECTRICAL POWER CONNECTION

A. C. Analyzers

Connect power cord to an a.c. source of 107 to 127 volts, either 60 ± 0.5 Hz or 50 ± 0.5 Hz. If power outlet does not have third (ground) contact, use an adapter to provide proper grounding.

Portable D.C. Analyzer

Insert battery pack in place, as shown in Figure 2-9.

2.4 SAMPLE CONNECTIONS AND SAMPLE-HANDLING RECOMMENDATIONS

Locations of sample inlet and outlet ports in the various analyzer configurations are shown in Figures 2-1 through 2-3. All analyzers have 1/8-inch bulkhead-type Swagelok fittings.

A suitable gas-handling system is required to deliver sample to the analyzer at the proper pressure and flow rate. Acceptable sample pressure range for the standard analyzer is 10 to 100 psig. A sample pressure outside this range necessitates installation of an appropriate accessory. Refer to the following table.

Sample Pressure	Accessory Device
10 inches Hg vacuum to +10 psig	Low-Pressure Sampling Accessory (630600 Accessory, for 60-Hz operation; or 630601 Accessory, for 50-Hz operation).
10 to 100 psig	None required.
100 to 2500 psig	A suitable pressure-reducing regulator.
1000 to 6000 psig	72765 High-Pressure Sampling Accessory.

Although installation of a sampling system is essentially straightforward, problems resulting from an improperly designed system can have a highly adverse effect on analyzer performance. Therefore, special care in planning the installation is required to ensure maximum reliability and accuracy.

In designing a sample system, refer to the following general rules, which are applicable to all installations and all analyzer configurations.

1. Use of stainless-steel tubing throughout is *strongly* recommended. Its smooth walls and passive surfaces minimize moisture absorption. Other metals, and plastics, increase system response time and decrease accuracy. Some plastics are entirely unsatisfactory, because of permeability to water vapor.

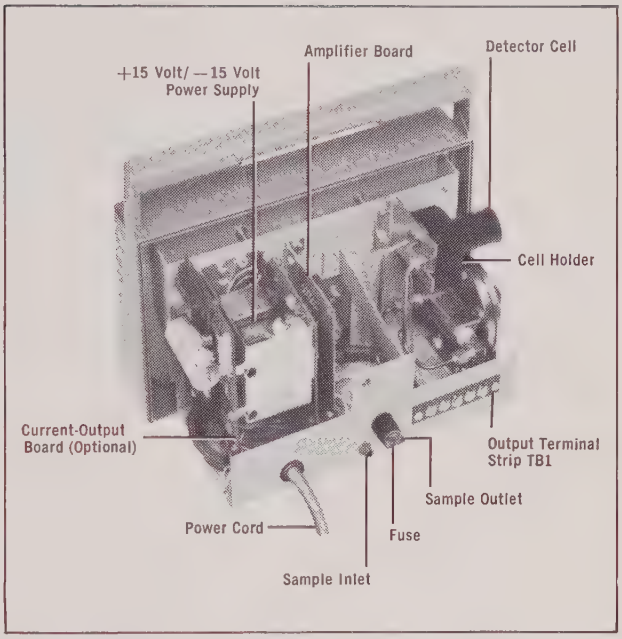


Figure 2-8. Interior of Portable A.C. Analyzer

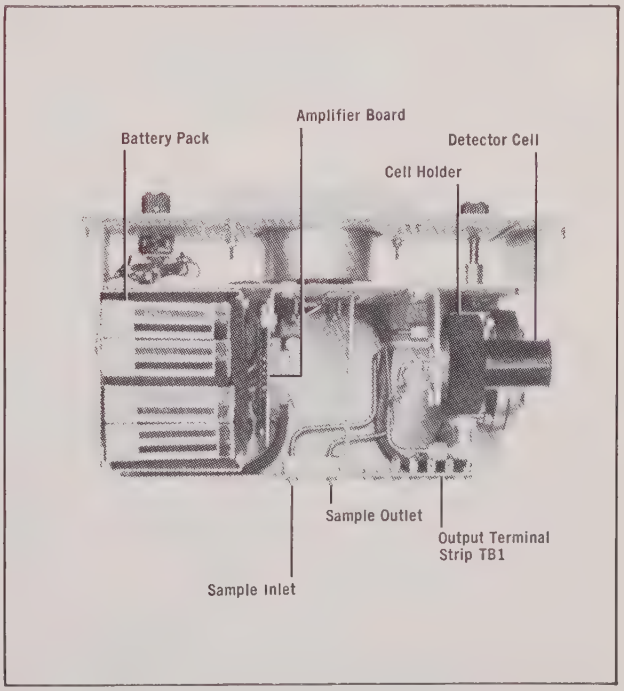


Figure 2-9. Interior of Portable D.C. Analyzer

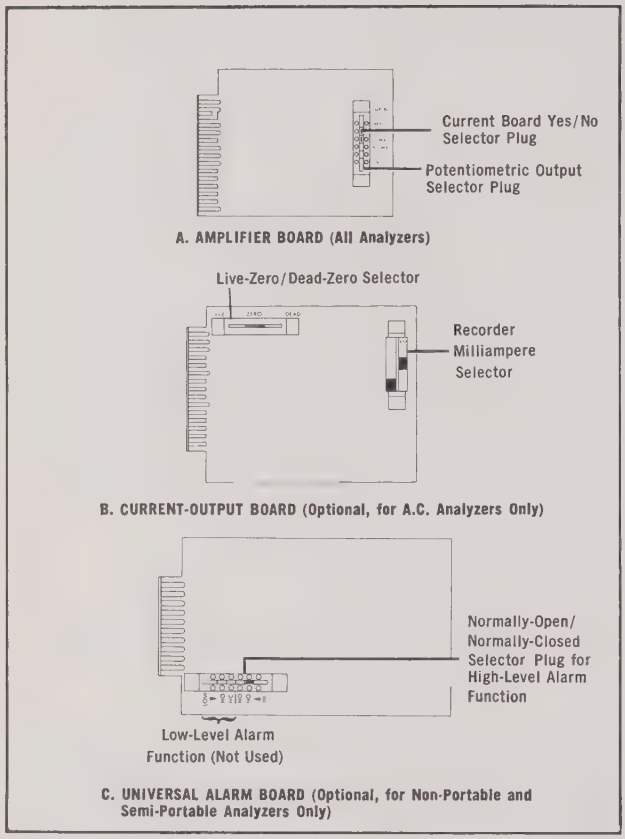

Current Board Yes/No Selector Plug
Potentiometric Output Selector Plug
A. AMPLIFIER BOARD (All Analyzers)
Live-Zero/Dead-Zero Selector
Recorder Milliampere Selector
B. CURRENT-OUTPUT BOARD (Optional, for A.C. Analyzers Only)
Normally-Open/ Normally-Closed Selector Plug for High-Level Alarm Function
Low-Level Alarm Function (Not Used)
C. UNIVERSAL ALARM BOARD (Optional, for Non-Portable and Semi-Portable Analyzers Only)

Figure 2-10. Locations of Selector Plugs on Circuit Boards

2. Tubing and other components in contact with sample must be scrupulously clean. Dirt and oil absorb water. Recommended cleaning procedure for tubing is as follows:
   a. Wash with acetone.
   b. Pass cleaning solution (10% nitric acid and 5% hydrofluoric acid in aqueous solution) through tubing until effluent is essentially colorless.
   c. Rinse with water and then with acetone.
   d. Purge with clean, dry, nitrogen or air.
3. Minimize internal surface area of sample system by using minimum-length, minimum-diameter lines. Generally, ⅛-inch o.d. tubing is recommended.
4. Provide high-velocity sample flow. Where pressure reduction is required before sample enters the instrument, an important factor is to locate the pressure regulator as near the process stream as possible.
5. Use minimum number of valves and fittings; each is a potential source of leaks.
6. Select components for minimum leakage and moisture absorption. With pressure regulators: (a) advise manufacturer of extreme low-leakage requirements, (b) choose units with metallic, *not* elastomeric, diaphragms. Use packless valves wherever possible. Where pipe fittings are required, seal with Teflon tape, *not* pipe-thread compound.
7. Avoid dead-ended passages, voids, and blind holes. They permit accumulation of stagnant gases, resulting in sluggish system response.

2.5 PURGE CONNECTIONS AND REQUIREMENTS

If required for safety, the detector and, or, control section(s) of any non-portable instrument *except* the Explosion-Proof Analyzer may be purged with clean, dry air or suitable inert gas. For locations of purge fittings, see Figure 2-1.

If purging is desired, use of the 191343 Purge Kit is recommended. This kit is designed to provide the Model 340 Trace Moisture Analyzer with Type Z air purge, per the recommended procedures of the Instrument Society of America (ISA). The kit, when installed as directed, is designed to improve the safety classification of the enclosure interior from Division 2 (normally non-hazardous) to non-hazardous. Refer to ISA-RP12.4, 1960. The kit consists of the following items:

Beckman Part Number	Description
190697	Purge Inlet Fitting
191342	Purge Outlet Fitting
191341	Warning Label

Installation options are shown in Figure 2-12. Use only clean, dry, air or suitable inert gas for the purge supply. Recommended supply pressure is 20 psig., which provides a flow of approximately 4 liters per minute (8.4 cfh), and a case pressure of approximately 1 inch H_2O. With a flow rate of 4 liters per minute, four case volumes of purge gas pass through the instrument case in 10 minutes.

All conduit connections through the instrument case must be sealed thoroughly with a suitable sealant. The sealant, to be applied from the *interior* of the case, must thoroughly cover all exiting leads as well as the conduit fitting.

NOTE

The warning label must be attached by the user in order to conform to ISA Type Z requirements.

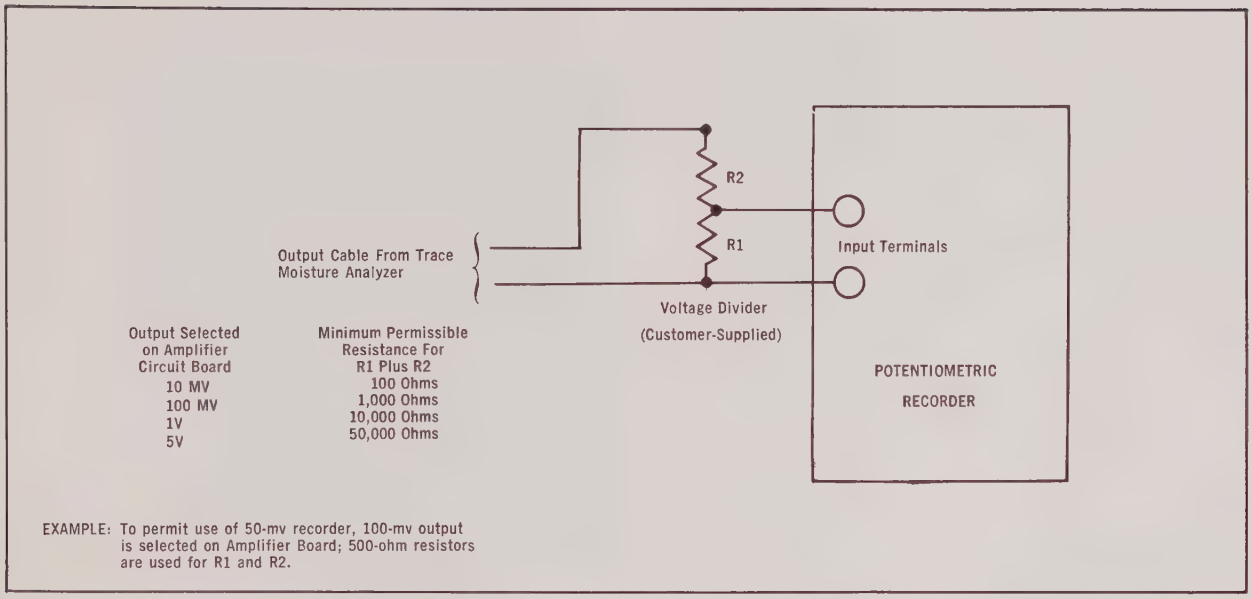


Figure 2-11. Connections for Potentiometric Recorder With Special Span

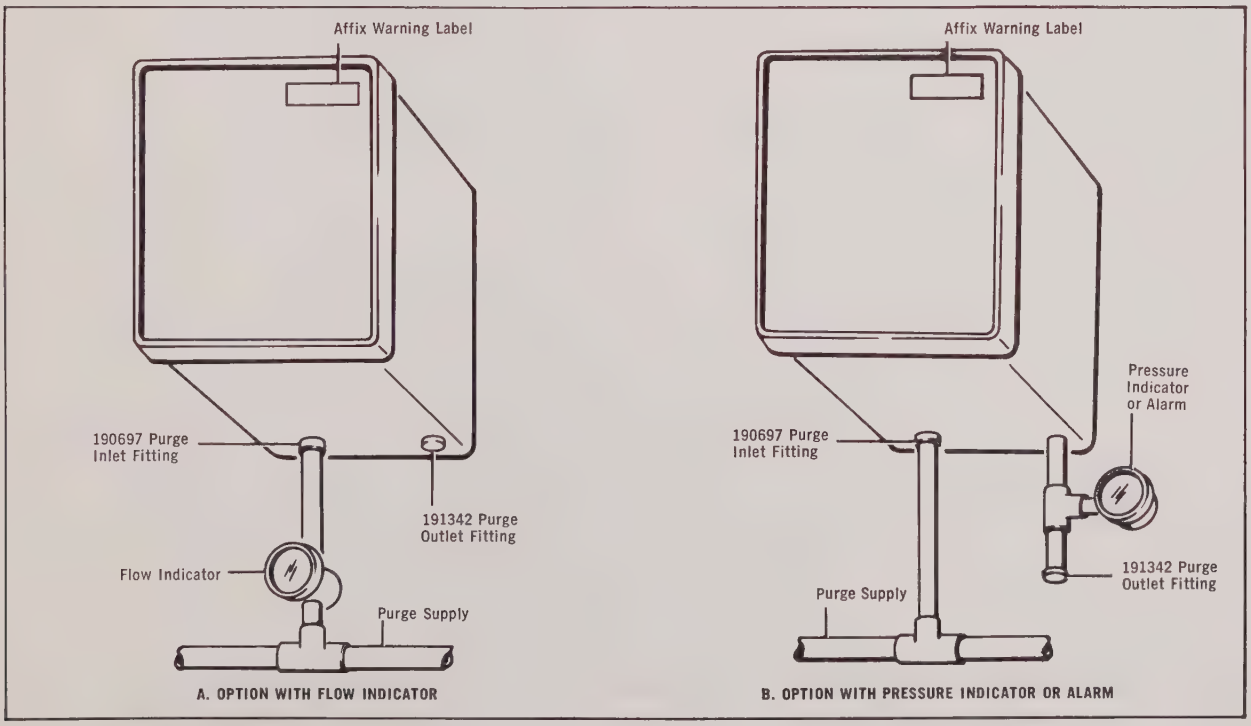


Figure 2-12. Installation of Purge Kit

SECTION THREE OPERATING CONTROLS AND INDICATORS

Preparatory to startup and operation, it is recommended that the operator familiarize himself with the instrument controls, described in the following paragraphs.

All Trace Moisture Analyzers incorporate similar operating controls; however, *locations* of these controls differ in the various instrument configurations. Refer to appropriate illustration of Figures 3-1 through 3-4.

3.1 RANGE SELECTOR SWITCH AND METER

The Range Selector Switch provides a choice of five operating ranges: 1000, 500, 100, 50, or 10 ppm. Range designations signify the value of a fullscale meter reading, in parts per million of water by volume (v/v). The meter scale is calibrated from 0 to 100%.

The STDBY position deactivates instrument readout, but maintains the electronic circuitry in energized condition, permitting immediate resumption of operation when Range Switch is turned to a numbered position. In standby mode, current flows continuously through the electrolytic cell to keep it dry.

At all times when sample gas is flowing through the cell, electrical power should be on and Range Selector Switch should be at either a numbered position or the STDBY position. Unless an electrical current is drying the cell, a prolonged flow of wet sample gas could wash the desiccant coating from the cell electrodes.

The OFF position removes electrical power from all circuits. Normally, this switch position is used only during instrument servicing, and then but briefly.

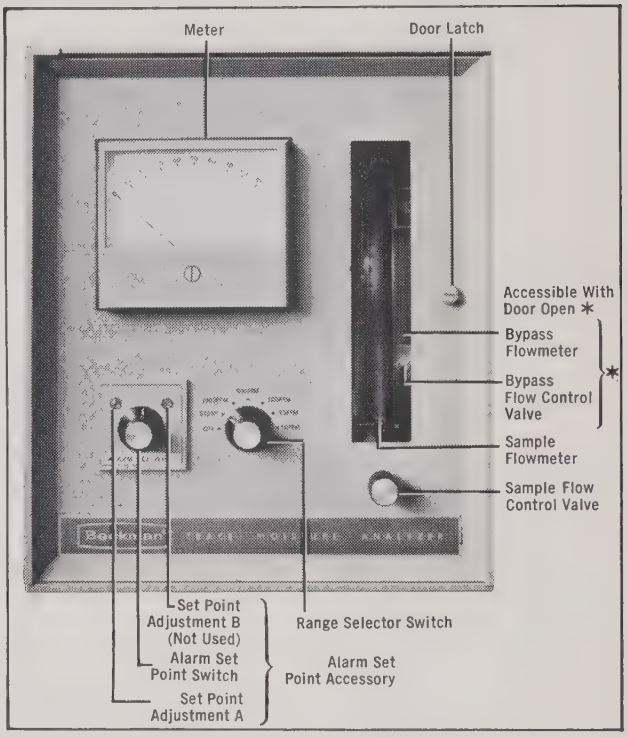


Figure 3-1. Operating Controls of Panel-Mounted/Semi-Portable Analyzer

3.2 SAMPLE FLOW CONTROL VALVE AND SAMPLE FLOWMETER

The Sample Flow Control Valve is provided in *all* instruments.

The Sample Flowmeter is a standard feature in all *non-portable and semi-portable* instruments For use with *portable* instruments, the Sample Flowmeter is incorporated into the optional Flowmeter Accessory.

The Sample Flow Control Valve adjusts the flow of sample gas through the electrolytic cell. Resultant *nominal* flow is indicated by the Sample Flowmeter. Refer to Paragraph 4.3.

CAUTION

To avoid damage to valve stem and seat, never overtighten Sample Flow Control Valve.

3.3 BYPASS FLOW CONTROL VALVE AND BYPASS FLOWMETER

The Bypass Flow Control Valve and Bypass Flowmeter are standard features of all *non-portable and semi-portable* instruments. For use with *portable* instruments, these two items are incorporated into the optional Flowmeter Accessory.

The valve adjusts the bypass flow. Resultant flow rate is indicated by the flowmeter. Bypass flow is adjustable from 0 to 2 cubic feet per hour (approximately 940 cc/min). Increasing the bypass flow decreases system response time.

3.4 CONTROLS OF ALARM SET POINT ACCESSORY (NON-PORTABLE AND SEMI-PORTABLE ANALYZERS ONLY)

The Alarm Set Point Accessory is used, in combination with the Universal Alarm Board, to actuate various alarm and, or, control systems.

Initially, the Alarm Set Point Switch is turned to position A, causing the meter to display the alarm set point. Then, Set Point Adjustment A is turned with a screwdriver to obtain the desired meter reading. Afterward, the Alarm Set Point Switch is turned to OPERATE. During subsequent operation, if the water-vapor concentration of the sample stream exceeds the selected level, the alarm circuit will actuate the external alarm system.

NOTE

In Trace Moisture Analyzers, position B of the Alarm Set Point Switch, and Set Point Adjustment B, are *inoperative.*

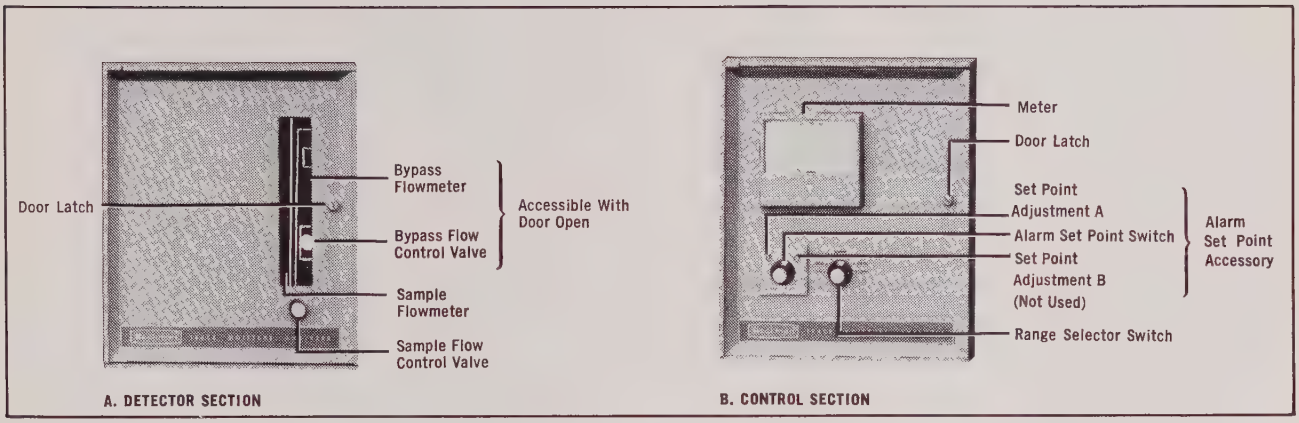


Figure 3-2. Operating Controls of Remote-Control Analyzer

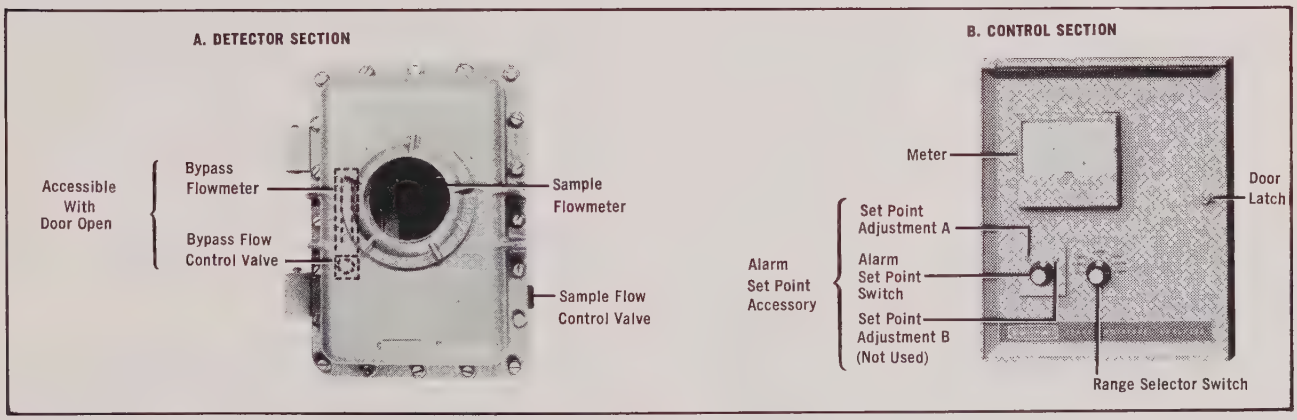


Figure 3-3. Operating Controls of Explosion-Proof Analyzer

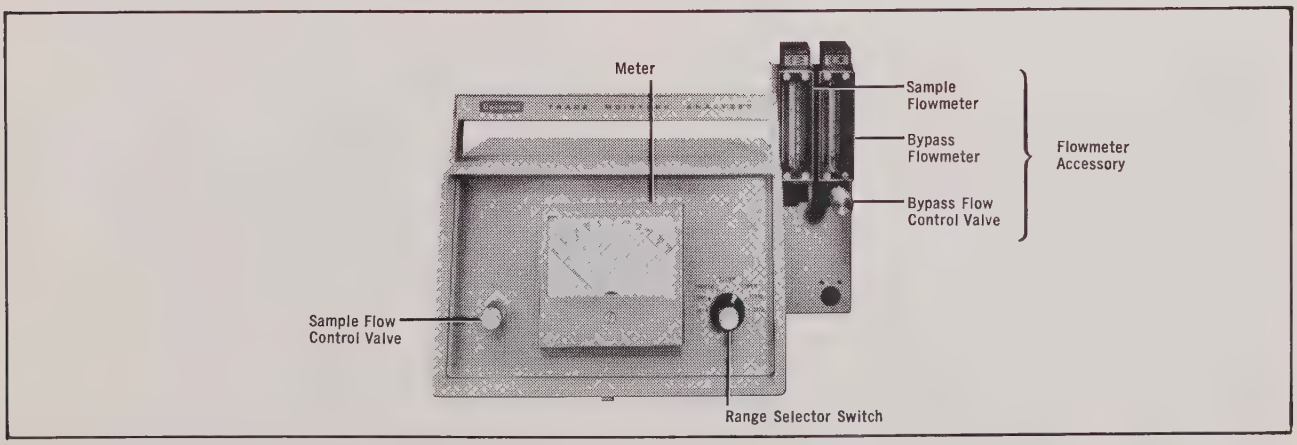


Figure 3-4. Operating Controls of Portable Analyzer and Flowmeter Accessory

SECTION FOUR STARTUP PROCEDURE FOR SYSTEMS UTILIZING PRESSURIZED SAMPLE GAS

NOTE

If the instrument does not function properly during startup and calibration procedure, use the tests and adjustments described in Section Nine, Service.

This section is applicable to all analysis systems *except* those utilizing the Low-Pressure Sampling Accessory. If this accessory is used, refer to Section Five.

Before attempting operation, complete the following procedures, *in the sequence given.*

1. Initial drydown, Paragraph 4.1.
2. System leak check, Paragraph 4.2.
3. Instrument calibration, by appropriate procedure of Paragraph 4.3.

4.1 INITIAL DRYDOWN

CAUTION

To avoid damaging the electrolytic cell, read the following instructions *before* beginning the drydown procedure.

1. *Before* supplying gas to sample inlet, close Sample Flow Control Valve, but do not overtighten. Turn Range Selector Switch to STDBY. Current will now flow through electrolytic cell, thus drying it.
2. Dry down the sample line and other elements of the *sample-handling system* as follows:
   a. Supply purging gas to sample inlet at a pressure of between 10 and 100 psig. Use of dry inert gas such as bottled nitrogen is recommended, particularly if sample contains corrosive or reactive components such as chlorine, hydrogen chloride, hydrogen sulfide, hydrogen, oxygen, or unsaturated hydrocarbons. However, if sample stream consists of an unreactive substance such as nitrogen, argon, helium, freon, methane, etc., use of bottled inert gas is unnecessary; the sample stream itself may be used as the purge gas.
   b. Establish a considerable bypass flow (2 cfh if sufficient gas is available). With non-portable or semi-portable analyzer (or portable analyzer utilizing bypass feature of Flowmeter Accessory) bypass is initiated by opening the Bypass Flow Control Valve. Purge system for several hours.
3. Check drydown of *electrolytic cell* by turning Range Selector Switch to 1000 PPM position; meter should read onscale. As cell dries down, turn Range Selector Switch to successively lower-numbered positions, always keeping the meter onscale. Continue until meter reads onscale on desired operating range.
4. Check drydown of the *sample-handling system* as follows:
   a. Slightly open the Sample Flow Control Valve to obtain a comparatively low flow; i.e., about 20 cc/min, as indicated by Sample Flowmeter (or other flow-measuring device used with portable analyzer).
   b. Turn Range Selector Switch to 1000 PPM; meter should read onscale.

CAUTION

If meter goes offscale on 1000 PPM range, sample-handling system is insufficiently purged. To avoid damaging the electrolytic cell, close Sample Flow Control Valve and continue the purging procedure of Step 2.

   c. When meter reads onscale on 1000 PPM range, turn Range Selector Switch to successively lower-numbered positions, always keeping the meter onscale. Continue until meter reads onscale on desired operating range.
5. Prepare for sample monitoring as follows:
   a. Return Range Selector Switch to 1000 PPM.
   b. Pass sample gas through instrument, if a different purge gas has been used during drydown.
   c. Set Sample Flow Control Valve for flow of *approximately* 100 cc/min, as indicated by Sample Flowmeter (or other auxiliary flow-measuring device used with portable analyzer). *Exact flow* required for accurate readout will be determined subsequently, as explained in Paragraph 4.3.
   d. Turn Range Selector Switch to successively lower-numbered positions, always keeping meter onscale, until meter reads onscale on desired operating range.

4.2 SYSTEM LEAK CHECK

An essential part of startup is elimination of even the smallest leaks from the sample-handling system. Note that water vapor will diffuse through a leak into a high-pressure gas system even though the overall gas flow is outward from the system. Movement of moisture through the leak is determined by the difference in water-vapor partial pressure across the leak, *not* the total pressure differential.

Small, hard-to-detect leaks are generally more troublesome than gross leaks; gas from a large leak tends to sweep away humid air from the vicinity and provide a surrounding blanket of sample gas. However, no leakage whatever should be tolerated. Leak detection and elimination can be time consuming and frustrating. To minimize expenditure of time, use either or both of the following leak-check procedures.

4.2.1 LEAK TESTING WITH SOAP SOLUTION

To test for leakage:

1. Connect sample-handling system to sample source and to Trace Moisture Analyzer. Sampling system should utilize a packless block valve for connection to the source, and will probably incorporate a pressure regulator and, or, a relief valve.

2. Adjust sample pressure to a value slightly below the setting of the pressure relief valve (if provided) or to about 50 psig (if relief valve not provided).
3. Close Sample and Bypass Flow Control Valves on Trace Moisture Analyzer.
4. Apply soap solution to all fittings and connections. Tighten any fittings where leakage is evident.

4.2.2 LEAK TESTING BY VARIABLE BYPASS METHOD

The following alternative or supplemental leak test is applicable to all non-portable and semi-portable analyzers, and also to portable analyzers that utilize the bypass feature of the Flowmeter Accessory. Usually, leakage from a given source into the sample system is relatively constant. Thus, leakage may be detected by varying the bypass flow rate while maintaining a constant sample flow rate through the electrolytic cell. For example, assume the sample stream has a given moisture level, and that a leak passes a small, constant flow of water vapor into the sample system. With a high bypass flow, a large percentage of the water entering the system through the leak passes through the bypass flowmeter to vent, and does not go through the electrolytic cell. If the bypass flow rate is reduced, however, a greater amount of the water vapor that leaks into the system is carried through the cell. Consequently, indicated moisture level is higher with a low bypass flow rate than with a high bypass flow rate.

Thus, the criterion for absence of leakage in the system is that indicated moisture level must be independent of bypass flow rate. After each change of bypass flow rate, allow sufficient time for the sample system to equilibrate before reading the meter.

4.3 INSTRUMENT CALIBRATION

Trace Moisture Analyzers are calibrated for direct readout in ppm H_2O by volume, based on a sample flow of 100 cc/min at 70°F and 14.7 psia. If sample conditions are other than those stated, appropriate corrections must be made.

Nominal flowmeter setting required for *air* sample gas under the specified conditions is 100. Compensation for the particular sample gas and, or, barometric pressure is made by using an appropriately chosen flowmeter setting, which may differ considerably from the nominal value of 100. If great accuracy is not required, the flowmeter setting required may be computed as explained in Paragraphs 4.3.1 and 4.3.2. For utmost accuracy, however, the flowmeter should be calibrated experimentally, as explained in Paragraph 4.3.3.

Temperature corrections, (applicable to *portable analyzers only*), are explained in Paragraph 4.3.4.

4.3.1 COMPUTATION OF SAMPLE FLOWMETER SETTINGS

Typical sample flowmeter settings required for various gases at a pressure of 14.7 psia (normal value at sea level) are listed in Figure 4-1.

For gases not listed in Figure 4-1, the *approximate* flowmeter setting required under standard conditions may be computed from the following equation:

$$FS_{sample} = FS_{air} \times \frac{V_{sample}}{V_{air}}$$

Where FS_{sample} = flowmeter setting for sample gas
FS_{air} = flowmeter setting for air (*nominal* value is 100)
V_{sample} = viscosity of sample gas
V_{air} = viscosity of air

Viscosity values are determined from handbook data; units must be the same for both air and sample gas.

Example: sample gas is hydrogen, viscosity 90 micropoise at 25°C; viscosity of air at this temperature is 182 micropoise.

$$FS_{sample} = 100 \times \frac{90}{182} = 49.5$$

SAMPLE GAS	FLOWMETER SETTING (CC/MIN)
Air	100
Argon	127
Carbon Dioxide	86
Hydrogen	46
Helium	103
Nitrogen	97
Oxygen	115
Methane	61
Ethane	54
Propane	52
Ethylene	59
Propylene	52
Butane	49
Sulfur Hexafluoride	100
Natural Gas	60

NOTE: Values are flowmeter readings corresponding to 100 cc/min flows of the gases listed, with sample outlet vented to atmospheric pressure at sea level (14.7 psia). Values are applicable only to Brooks flowmeters. These values were determined experimentally, on a single flowmeter. For greatest accuracy, proper setting for the individual flowmeter should be determined experimentally, by the most appropriate method of Paragraph 4.3.3.

Figure 4-1. Typical Settings for Sample Flowmeter

4.3.2 PRESSURE (ELEVATION) CORRECTIONS TO COMPUTED FLOWMETER VALUES

The sample flowmeter is factory-calibrated at sea level, with outlet end vented to atmospheric pressure (14.7 psia). At elevations appreciably above sea level, the flowmeter setting must be changed appropriately to compensate for reduced barometric pressure. The required sample flowmeter setting may be determined from the following equation.

$$FS_{op} = FS_{cal} \times \frac{14.7 \text{ psia}}{\text{barometric pressure at instrument}}$$

where FS_{op} is sample flowmeter setting required for operation.

FS_{cal} is sample flowmeter setting during calibration, as determined from the table of Figure 4-1, or computed from the equation of Paragraph 4.3.1.

If actual barometric pressure at the installation site is not known, use Figure 4-2 to determine normal barometric pressure at the elevation involved.

The following example will clarify use of the equation.

Example: What flowmeter setting is required for carbon dioxide sample gas in an instrument at an elevation of 4000 feet?

Solution: From Figure 4-1, flowmeter setting required for CO_2 at sea level is 86. Therefore,

$$\text{setting for 4000 feet} = 86 \times \frac{14.7}{12.6} = 100.3.$$

4.3.3 EXPERIMENTAL CALIBRATION OF SAMPLE FLOWMETER

For utmost accuracy, the sample flowmeter should be calibrated experimentally, at the installation site, with the particular sample gas. Such calibration compensates automatically for effects of sample gas and barometric pressure. Alternative methods are:

1. Liquid Displacement: This method is suitable for all sample streams except those containing water-soluble gases, such as SO_2 or CO_2. A graduated cylinder filled with water is inverted into a beaker of water. Gas from the instrument outlet is brought by hose to the bottom of the cylinder. The time required to displace a given quantity of water from the cylinder is a measurement of the flow rate. (An error, negligible for most applications, is introduced by the pressure of the water column in the cylinder and by the small amount of sample gas that dissolves in the water.)
2. Soap-Bubble Flow Measurement: This method is suitable for all sample streams except those containing water-soluble gases or hydrogen (which diffuses through the soap film). The method requires use of a 50 cc laboratory burette, preferably fitted with a 3-way stopcock. The 107783W Soap Bubble Flowmeter is particularly recommended. Connect instrument outlet to the bottom of the burette. Above the stopcock at the base of the burette, place a few drops of detergent or soap-bubble solution. Open gas flow.

   The detergent or solution will move up the burette in a series of flat film disks, ultimately traveling about ½ to 1 inch apart. With a stopwatch, time one of these "plates" as it passes the initial 50 cc mark and ascends to the 0 cc graduation. Repeat the procedure until reproducibility is satisfactory. Back pressure is insignificant, and corrections for atmospheric pressure and temperature usually are not necessary.
3. Gas Displacement: This method is suitable for all sample gases, and is particularly recommended for those not compatible with Method 1 or 2. Proceed as follows:
   a. Connect instrument as shown in Figure 4-3. Use good quality instrument air or bottled air, with moisture content of less than 100 ppm.
   b. Turn Range Selector Switch to STDBY; fully open Sample Flow Control Valve. If Bypass Flow Control Valve is provided, turn it fully closed.
   c. Set air and sample-gas pressure regulators for any constant pressure between 10 and 50 psig. Close needle valve on sample line; open needle valve on air line until sample flowmeter indicates approximately 100 cc/min, then wait for air to flow a few minutes.
   d. Adjust needle valve on air line for flow of exactly 100 cc/min as indicated by the soap bubble flowmeter; note resultant reading on sample flowmeter. Allow air to flow several minutes, then close valve on air line.

ELEVATION ABOVE SEA LEVEL (FEET)	NORMAL BAROMETRIC PRESSURE		
	PSIA	MM OF MERCURY	INCHES OF MERCURY
0	14.7	760	30.0
350	14.5	750	29.6
700	14.3	740	29.2
1050	14.1	730	28.9
1400	13.9	720	28.4
1750	13.7	710	28.0
2100	13.5	700	27.6
2450	13.3	690	27.2
2800	13.2	680	26.8
3200	13.0	670	26.4
3600	12.8	660	26.1
4000	12.6	650	25.7
4400	12.4	640	25.3
4800	12.2	630	24.9
5200	12.0	620	24.5
5600	11.8	610	24.1
6050	11.6	600	23.7
6500	11.4	590	23.3
6920	11.2	580	22.9
7410	11.0	570	22.5
7900	10.8	560	22.1

Figure 4-2. Normal Barometric Pressures for Various Elevations

e. Open needle valve on sample line until sample flowmeter reads the same as in Step d. Now observe sample flowmeter. Initial reading is that corresponding to 100 cc/min of *air*. As soon as sample gas displaces air from ¼-inch tubing, however, reading will change, and will stabilize at a new value. The final reading is that required for 100 cc/min of *sample gas*.

4.3.4 TEMPERATURE CORRECTIONS (PORTABLE ANALYZERS ONLY)

Operation of *portable* analyzers at temperatures above or below 70°F results in a readout error. Factors involved are the gas-law influence and the effect on the flowmeter.

If it is desired to correct for temperature effects, take all meter readings with sample flowmeter set at the correct value for operation at 70°F. Then, algebraically add the following correction to each meter reading.

$$\text{Correction} = 0.003 \times (\text{actual reading}) \times (\text{actual temperature, °F} - 70)$$

Example 1: Meter reads 50 ppm at 90°F

$$\text{Required correction} = 0.003 \times 50 \times (90\text{-}70) = +3 \text{ ppm}$$

$$\text{Corrected reading} = 50 + 3 = 53 \text{ ppm}$$

Example 2: Meter reads 100 ppm at 50°F

$$\text{Required correction} = 0.003 \times 100 \times (50\text{-}70) = -6 \text{ ppm}$$

$$\text{Corrected reading} = 100\text{-}6 = 94 \text{ ppm}$$

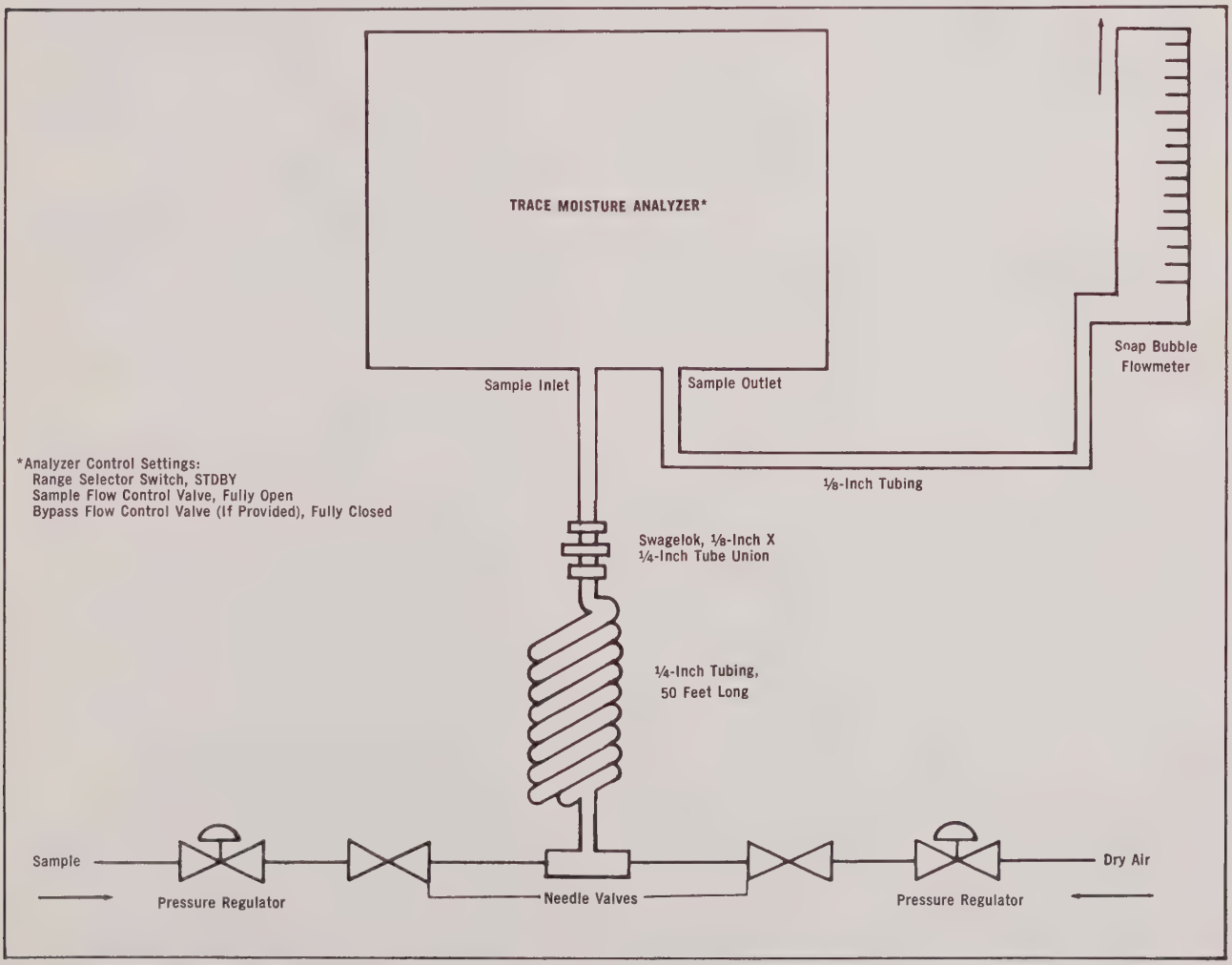


Figure 4-3. Calibration of Sample Flowmeter by Gas Displacement Method

SECTION FIVE STARTUP PROCEDURE FOR SYSTEMS UTILIZING THE LOW-PRESSURE SAMPLING ACCESSORY

NOTE

If the instrument does not function properly during startup and calibration procedure, use the tests and adjustments described in Section Nine, Service.

The Low-Pressure Sampling Accessory, Figure 5-1, permits use of a Model 340 Trace Moisture Analyzer to monitor gas sources at reduced pressures ranging from 10 inches of mercury vacuum to + 10 psig. Typical applications include measuring moisture concentrations in blanketing gases and in dry boxes.

The accessory is available in two versions: 630600 Accessory, for 115-volt, 60-Hz operation; and 630601 Accessory, for 115-volt, 50-Hz operation. They differ only in the electrical frequency requirement.

Normally, startup and operation of a low-pressure trace moisture analysis system entail use of two different interconnection configurations, in turn.

1. Preparatory to initial operation, the system is *temporarily* connected as shown in A of Figure 5-2, to obtain an exact, experimental calibration of the Sample Flowmeter in the Trace Moisture Analyzer. In this configuration, the accessory supplies *pressurized* sample to the analyzer inlet.
2. For subsequent *normal operation,* the system is connected as shown in B of Figure 5-2. In this configuration, the accessory applies a *vacuum* to the analyzer *outlet,* thus establishing a pressure differential which causes sample to enter the analyzer inlet.

   To set up the analysis system for operation, perform the procedures described in the following Paragraphs, *in the sequence given.*

5.1 CALIBRATION PROCEDURE FOR SAMPLE FLOWMETER OF TRACE MOISTURE ANALYZER

To permit computation of the correct flowmeter setting required for low-pressure operation, it is necessary first to determine the setting required for a flow of 100 cc/min of the particular gas, *with flowmeter outlet vented to atmospheric pressure.* The latter value is listed, for various pure gases, in Figure 4-1. Generally, these data are accurate to better than ±10%. If greater accuracy is desired, or if the application involves a sample gas of unknown characteristics, the Sample Flowmeter should be calibrated experimentally, as explained in the following steps.

1. Connect Trace Moisture Analyzer, Low Pressure Accessory, and soap bubble flowmeter (or other accurate flow-measuring device) in *calibration configuration,* A of Figure 5-2. Sample Flowmeter of analyzer now discharges to atmospheric pressure.
2. On Trace Moisture Analyzer, turn Range Selector Switch to STDBY; fully close Sample Flow Control Valve; fully open Bypass Flow Control Valve (if provided).

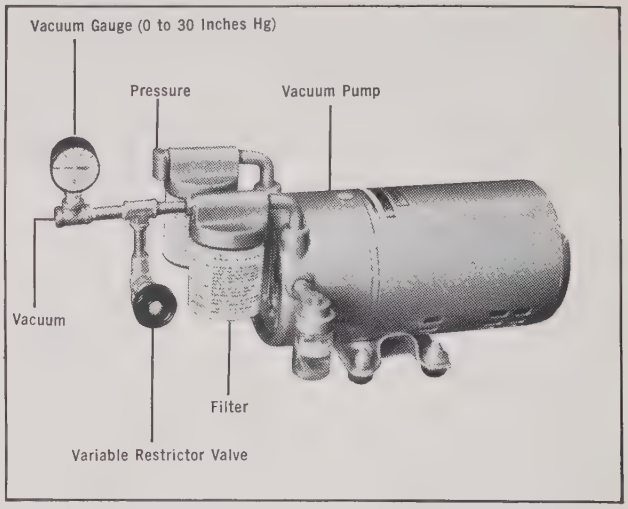


Figure 5-1. Low-Pressure Sampling Accessory

CAUTION

At all times when gas is flowing through the analyzer, electrical power should be on, and Range Selector Switch should be at either STDBY or a numbered position. This precaution protects the electrolytic cell from possible overloading with excessive moisture.

3. Adjust controls on Low Pressure Accessory as follows:
   a. Fully open Variable Restrictor Valve.
   b. Start vacuum pump.
   c. Close Variable Restrictor Valve.
4. Adjust controls on Trace Moisture Analyzer as follows:
   a. Adjust Sample Flow Control Valve so Sample Flowmeter reads approximately 100.
   b. Close Bypass Flow Control Valve.
   c. Readjust Sample Flow Control Valve so Sample Flowmeter again reads approximately 100.
   d. Measure *actual* flow rate with soap-bubble flowmeter, or by gas or liquid displacement. (Refer to Paragraph 4.3.3.) On basis of the result obtained, readjust Sample Flow Control Valve to obtain actual flow of approximately 100 cc/min. Such trial-and-error adjustment can be continued until an *exact* flow of 100 cc/min is obtained; however, this approach can be time consuming. Therefore, a suggested alternative method is to measure the flow at several different settings on the Sample Flowmeter. Plot a curve of actual flow values versus Sample Flowmeter settings. Interpolation on this curve will indicate the Sample Flowmeter setting required for a sample flow of 100 cc/min.
5. Turn off vacuum pump.

CAUTION

Do not run vacuum pump longer than is required to obtain flowmeter calibration. Prolonged operation under these conditions may damage pump.

6. Connect Trace Moisture Analyzer and Low Pressure Accessory in *normal operating configuration*, B of Figure 5-2. Hereafter, system will *remain* in this configuration unless re-check of flowmeter calibration is desired.

5.2 OPERATING PARAMETER SELECTION

Proper operation of the low-pressure analysis system is dependent on selection of a compatible combination of readings on: (1) the Vacuum Gauge of the Low Pressure Accessory, and (2) the Sample Flowmeter of the Trace Moisture Analyzer. The following Paragraphs explain selection of these parameters.

5.2.1 VACUUM READING

Within the Trace Moisture Analyzer, the Sample Flowmeter discharges directly to the sample outlet, (as shown in Figure 7-2). Therefore, during the *flow-measurement* procedure of Paragraph 5.1, the Sample Flowmeter discharged to *atmospheric pressure* as shown in A of Figure 5-2.

During subsequent *operation*, the Sample Flowmeter will discharge into a *vacuum*, indicated on the gauge of the *Low*

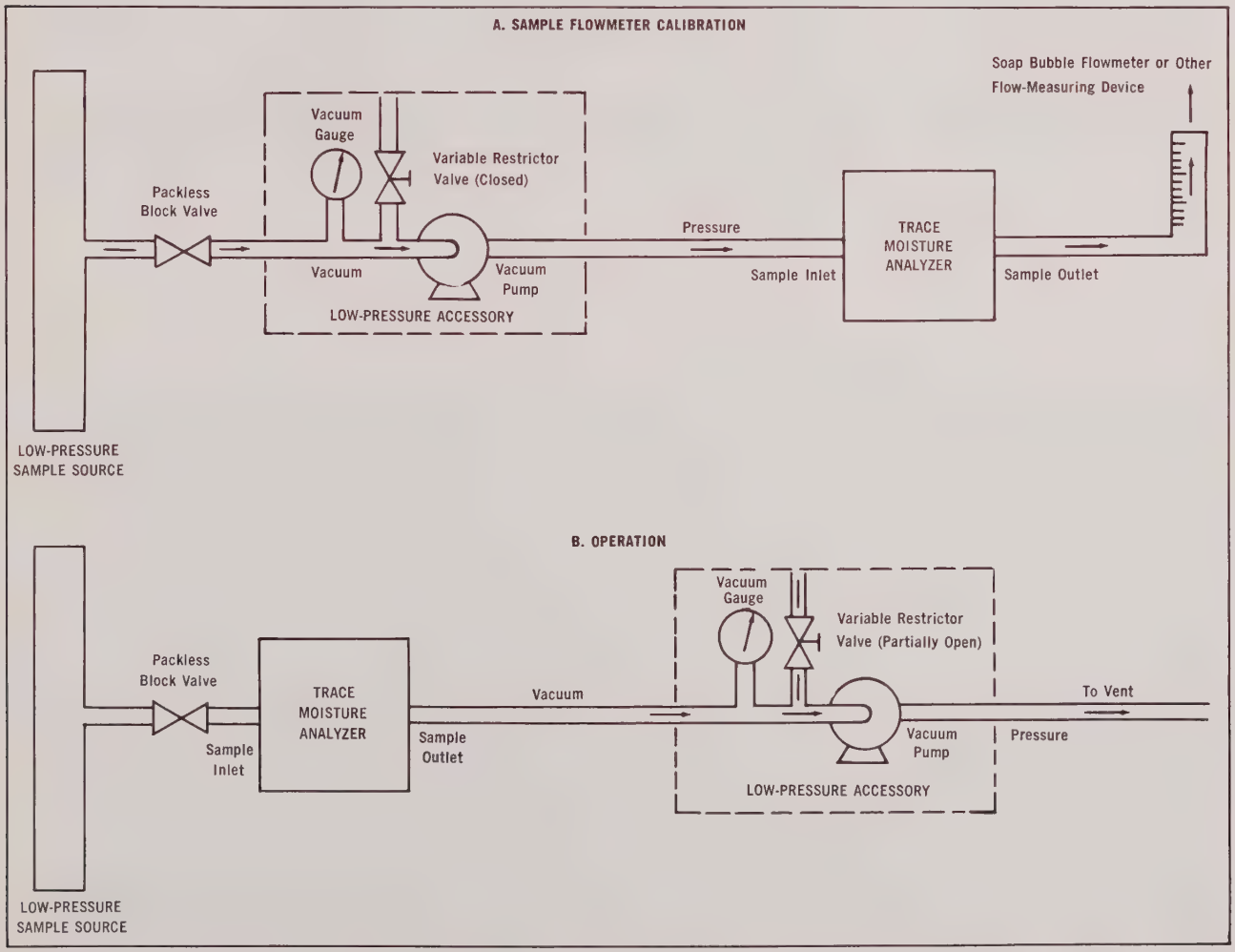


Figure 5-2. Interconnection of Low-Pressure Analysis System

Pressure Accessory, as shown in B of Figure 5-2. The vacuum is adjustable via various valves in the system. Proper vacuum reading depends on sample supply pressure. Basic consideration is that the pressure differential must be sufficient to ensure adequate sample and bypass flows through the analyzer. Commonly, a vacuum of 10 inches Hg is used, at least for initial trial operation.

5.2.2 SAMPLE FLOWMETER SETTING

Model 340 Trace Moisture Analyzers are factory-calibrated for direct readout in ppm H_2O by volume, based on a sample gas flow of 100 cc/min at a pressure of 30 inches of mercury (normal barometric pressure at sea level). Compensation for the particular operating pressure is made through use of an appropriately chosen setting for the Sample Flowmeter. Compute the proper operating setting from the following equation.

$$FS_{op} = FS_{atm} \times \frac{P_{atm}}{P_{atm} - P_{vg}}$$

where FS_{op} = Required reading on Sample Flowmeter for *normal operation* (with reading of P_{vg} on vacuum gauge of Low Pressure Accessory).

FS_{atm} = Reading obtained on Sample Flowmeter, during *calibration*, with actual sample flow of 100 cc/min discharged to atmospheric pressure.

P_{atm} = Absolute atmospheric pressure, in inches of mercury. For maximum accuracy, use the actual barometric pressure at the installation site. If this value is not known, use Figure 4-2 to determine the normal barometric pressure at the particular elevation.

P_{vg} = Reading on vacuum gauge of Low Pressure Accessory during *normal operation.*

Example:

At a sea-level installation, an instrument system is connected in the *calibration* configuration, A of Figure 5-2. With the particular sample gas flowing, the soap bubble flowmeter indicates an *actual* flow of 100 cc/min discharged to atmospheric pressure, while the Sample Flowmeter in the analyzer reads 85.

The system is now connected in the *operating* configuration, B of Figure 5-2. What is the required reading on the Sample Flowmeter?

Solution: $FS_{atm} = 85$

$P_{atm} = 30$ in. Hg. (normal value at sea level)

$P_{vg} = 10$ in. Hg

Substituting these values in the equation,

$$FS_{op} = 85 \times \frac{30}{(30\text{-}10)} = 128$$

5.3 SETUP FOR NORMAL OPERATION

With Trace Moisture Analyzer and Low Pressure Accessory connected in *normal operating configuration*, B of Figure 5-2, proceed as follows:

1. Set controls on Trace Moisture Analyzer as follows:
   Range Selector Switch, STDBY
   Sample Flow Control Valve } Fully Closed.
   Bypass Flow Control Valve }
2. Adjust controls on Low Pressure Accessory as follows:
   a. Fully open Variable Restrictor Valve.
   b. Start vacuum pump.
   c. Adjust Variable Restrictor Valve for reading of 10 inches Hg (or other selected value) on Vacuum Gauge.
3. On Trace Moisture Analyzer, open Bypass Flow Control Valve until ball of Bypass Flowmeter is within the upper third of the flowmeter tube, but *not* against the upper stop. Before proceeding further, allow instrument to dry down for at least one hour, and preferably for several hours.
4. On Trace Moisture Analyzer, open Sample Flow Control Valve until Sample Flowmeter indicates the value calculated from the equation given in Paragraph 5.2.2.
5. Note reading on vacuum gauge of Low Pressure Accessory; if unchanged from Step 2c, proceed directly to Step 6.

   If reading has changed, recompute the Sample Flowmeter setting by substituting the *present* vacuum reading in the equation. Then, readjust the Sample Flow Control Valve to obtain the calculated reading on the Sample Flowmeter. To obtain the particular flowmeter setting *at the given vacuum reading*, it may be necessary to adjust valves in the following sequence:

   Sample Flow Control Valve on analyzer
   Bypass Flow Control Valve on analyzer
   Variable Restrictor Valve on accessory

6. Turn Range Selector Switch to lowest range which gives an onscale reading. Allow instrument to dry down for at least several hours, and preferably overnight.
7. Check reading on Sample Flowmeter; if other than correct value, readjust Sample Flow Control Valve as required.
8. Turn Range Selector Switch to lowest range which gives an onscale reading.

   System is now in operation. For additional information on routine operation, refer to Section Six.

   If the system utilizes a *portable* Trace Moisture Analyzer, and if the operating temperature differs appreciably from 70°F, temperature corrections may be desirable. Refer to Paragraph 4.3.4.

SECTION SIX OPERATION

6.1 ROUTINE OPERATION

After completing system startup, use following operating procedure:

1. Turn on sample gas.
2. Verify that sample flowmeter reading is equivalent to 100 cc/min at 14.7 psia and 70°F (21.1°C). Refer to Paragraph 4.3. (If Low-Pressure Sampling Accessory is used, check readings on both its vacuum gauge and the sample flowmeter of the Trace Moisture Analyzer. Refer to Paragraph 5.2.)
3. Turn Range Selector Switch to appropriate position. Meter (and recorder, if used) will now automatically and continuously indicate the water-vapor content of the sample stream, in parts-per-million by volume. To convert readings into weight-per-volume or weight-per-weight units, multiply by the appropriate factor from the table of Figure 6-1. To convert readings into frost-point temperatures, use the curve of Figure 6.2.

6.2 RECOMMENDED CALIBRATION FREQUENCY

At least once a week, note reading on sample flowmeter. If reading deviates from correct value, as previously determined, readjust Sample Flow Control Valve.

Less frequently, calibration of the sample flowmeter should be re-checked by one of the methods from Paragraph 4.3.3. Flowmeter characteristics may change gradually with internal deposition of dirt and other contaminants. Proper frequency for the calibration check depends on the particular sample stream, and is therefore best determined by experience.

6.3 SHUTDOWN

Normally, electrical power is never removed from the analyzer. Exceptions are: (1) brief power turn-off as required for routine maintenance; and (2) power turn-off during prolonged shutdown of several weeks or more.

During periods of inactivity, Range Selector Switch should be left at STDBY. In standby mode, current flows through the electrolytic cell, thus keeping it dry and ready for immediate use upon resumption of operation.

If analyzer is to be used on a semi-continuous basis, e.g., during daylight working hours only, sampling system should incorporate shutoff valve(s) to prevent entry of moist air during inactive periods.

TO CONVERT B TO A MULTIPLY BY:	A	B	TO CONVERT A TO B MULTIPLY BY:
10^4	PPM (v/v)	Volume %	10^{-4}
$(MW/1.8) \times 10^3$	PPM (v/v)	Weight %	$(1.8/MW) \times 10^{-3}$
10^3	PPM (v/v)	Ml/Liter	10^{-3}
1.25×10^3	PPM (v/v)	Mg/Liter	8.04×10^{-4}
35.4	PPM (v/v)	Ml/Cu. Ft.	2.83×10^{-2}
43.8	PPM (v/v)	Mg/Cu. Ft.	2.28×10^{-2}
2.86×10^3	PPM (v/v)	Grain/Cu. Ft.	3.50×10^{-4}
$(MW/1.8) \times 10^2$	PPM (v/v)	Mg/Gram	$(1.8/MW) \times 10^{-2}$
$(MW/8.2) \times 10^3$	PPM (v/v)	Gram/Pound	$(8.2/MW) \times 10^{-3}$
$(MW/1.26) \times 10$	PPM (v/v)	Grain/Pound	$(1.26/MW) \times 10^{-1}$
$(MW/1.8) \times 10^5$	PPM (v/v)	Pound/Pound	$(1.8/MW) \times 10^{-5}$
20	PPM (v/v)	Gram/MMCF	5×10^{-2}

NOTE: MW = molecular weight of the gas involved.

Figure 6-1. Conversion Factors for Water-Vapor Concentrations

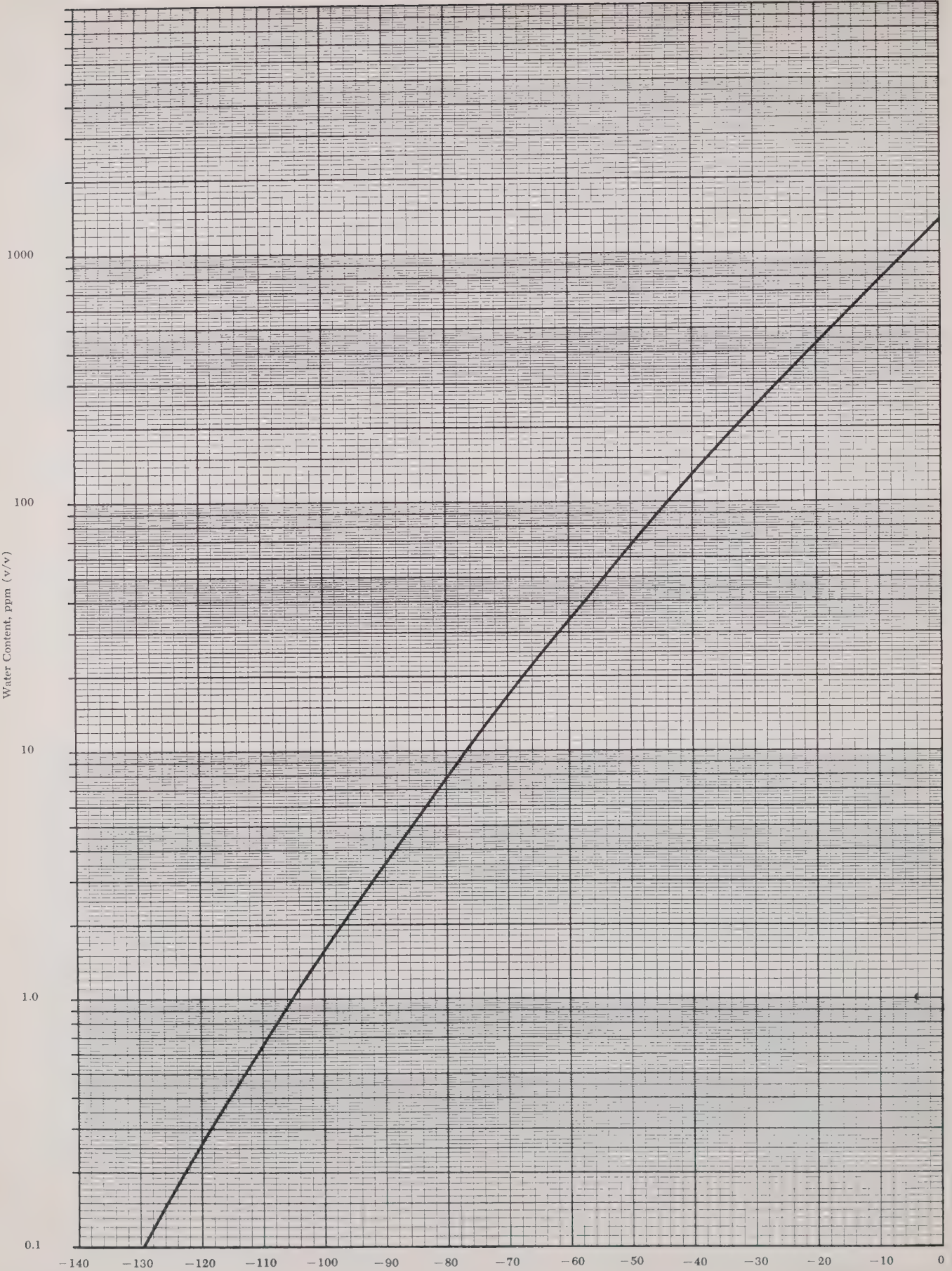


Figure 6-2. Ice Point Versus Parts-Per-Million H_2O by Volume

7.1 PRINCIPLE OF OPERATION

Trace moisture determination is based on the simultaneous absorption and electrolysis of water. The sensor is an electrolytic cell, Figure 7-1. Inside the molded plastic cell, the sample flows through a tube formed of two slightly separated rhodium-wire helices. The outer surface of the tube is a substrate that firmly secures the wires in place. The inner surface is a thin film of desiccant, meta phosphoric acid, which absorbs water vapor from the sample.

A regulated d.c. voltage is applied between the helical electrodes, causing a current to flow through the film and thus electrolyze the absorbed water. The current is directly proportional to the water-vapor content of the sample. The instrument is calibrated to provide direct readout of sample moisture in ppm by volume (for sample flow of 100 cc/min at 70°F and 14.7 psia). If desired, readings may be converted into various weight-per-volume and weight-per-weight units through use of the corresponding conversion factors listed in Figure 6-1.

7.2 FLOW SYSTEM

Internal flow system of the analyzer is shown in Figure 7-2. To provide sample flow through the system, a suitable pressure differential must be established between sample inlet and outlet. In most applications, the inlet is connected to a *pressurized* sample source; the outlet discharges to atmospheric pressure. In applications utilizing the Low Pressure Sampling Accessory, the inlet is connected to a comparatively low-pressure sample source; and a vacuum is applied to the outlet.

The Sample Flow Control Valve is adjusted so that flow through the electrolytic cell is equivalent to 100 cc/min under standard conditions (70°F, 14.7 psia). The sample flowmeter is calibrated by its manufacturer for direct readout in cc/min under the following conditions: (1) sample gas, air; (2) temperature, 70°F, 21.1°C; (3) flowmeter outlet vented to atmospheric pressure at sea level (14.7 psia). For ultimate accuracy, however, the user should recalibrate the sample flowmeter for the particular sample gas, and for the actual discharge pressure if significantly less than 14.7 psia. In an analyzer used to monitor sample from a pressurized source, the flowmeter outlet is at the local barometric pressure. This may be considerably less than 14.7 psia if the installation site is at an appreciable elevation above sea level. Refer to Paragraph 4.3. With the Low Pressure Sampling Accessory, the flowmeter outlet discharges into a vacuum, necessitating the special calibration considerations explained in Paragraph 5.2.

To stabilize sample flow at the established level, the system incorporates a flow controller. The controller has two sides, separated by a diaphragm. One side connects to the upstream end, and the other side to the downstream end, of the Sample Flow Control Valve. Any pressure imbalance across the diaphragm causes an internal valve within the controller to open or close until equilibrium is achieved. At equilibrium, reached after initial flow through the system, a constant flow is maintained through the cell.

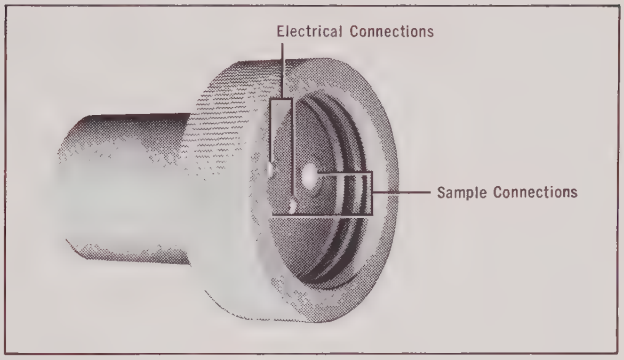


Figure 7-1. Electrolytic Cell

In non-portable and semi-portable analyzers, a thermostatically-controlled heating circuit maintains the flow controller at a constant temperature.

The Bypass Flow Control Valve and bypass flowmeter, if used, permit a portion of the sample to circumvent (bypass) the cell. Opening the bypass valve results in a high-velocity flow through the sample lines, thus minimizing transport time lag.

7.3 ELECTRONIC CIRCUITRY

The following paragraphs discuss electronic circuitry of the Trace Moisture Analyzer. For *overall* schematic and pictorial diagrams of the particular instrument version, refer to the appropriate figures listed in the following table. *Details* of individual circuits are shown in separate schematic and pictorial diagrams, as referenced in the overall diagrams.

Instrument	Schematic Diagram	Pictorial Diagram
Panel-Mounted/Semi-Portable, Remote-Control, and Explosion-Proof Analyzers	Figure 9-1	Figure 9-2
A.C.-Operated Portable Analyzer	Figure 9-3	Figure 9-4
D.C.-Operated Portable Analyzer	Figure 9-5	Figure 9-6

7.3.1 ELECTROLYTIC CELL AND ATTENUATOR SWITCH ASSEMBLY (ALL ANALYZERS)

During operation, the electrolytic current flows through the cell and through one of five range resistors, depending on the setting of Range Selector Switch S1. The resultant signal developed across the particular range resistor is applied to the input of a d.c. operational amplifier circuit utilizing a high-gain d.c. amplifier on the amplifier circuit board (Paragraph 7.3.2). Switch S1 provides the capability of changing

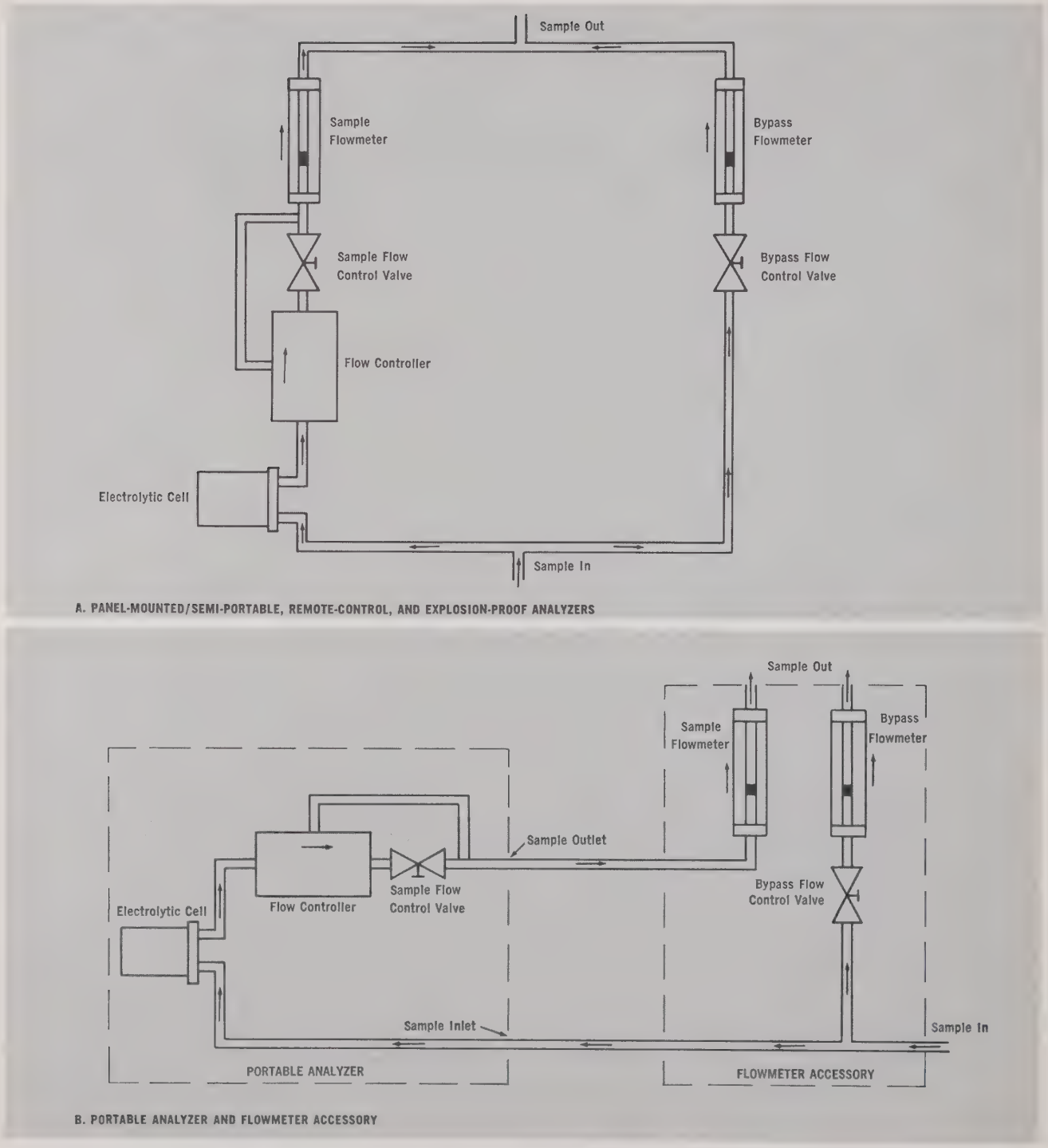


Figure 7-2. Schematic Diagram of Internal Flow System

the sensitivity of the current-measuring circuitry, to permit selection of different operating ranges.

Switch S1 and range resistors R3 through R7 are contained in the 193155 Attenuator Switch Assembly. Also mounted on the switch assembly are resistors R1 and R2, which constitute a feedback divider for the amplifier circuit.

7.3.2 AMPLIFIER CIRCUIT BOARD (ALL ANALYZERS)

The amplifier circuit board, Figure 9-7, contains the following circuits and components:

1. *High-Gain D.C. Amplifier*, utilized in the amplifier circuit described in Paragraph 7.3.1.
2. *Potentiometric Output Selector*
   The Potentiometric Output Selector consists of a multipin receptacle and two associated shorting plugs. The combination constitutes a switch, labeled S1 on the circuit board. Plug functions are:
   a. *Plug for CUR. BD. YES/NO Selector*
      If potentiometric output is desired, the plug is inserted between the pair of pins labeled NO. This connection routes the amplifier-output signal through a voltage divider to circuit ground.

      If current output is desired, the plug is inserted between the pair of pins labeled YES. This connection routes the amplifier-output signal to the current-output board, described in Paragraph 7.3.3.
   b. *Plug for Numbered Pairs of Pins*
      To match instrument output to the desired potentiometric recorder, a shorting plug must be inserted between the corresponding pair of numerically labeled pins, thus selecting the appropriate tap on the voltage divider mentioned in item "a," preceding. Choices are 10 mv, 100 mv, 1 volt, and 5 volts. Circuit parameters are such that, with the plug in the position appropriate to the particular recorder, a signal-voltage level of +5 volts at the amplifier output results in a fullscale recorder deflection.

7.3.3 CURRENT-OUTPUT BOARD (OPTIONAL, FOR A.C. ANALYZERS ONLY)

The current-output circuit board, Figure 9-10, contains the following circuits and components:

1. An emitter-follower stage. It uses Darlington-connected transistors Q23 and Q24 to convert the signal from the amplifier board into an output suitable for driving a current recorder.

   To protect Q23 and Q24 from accidental overload, a current-limiting circuit is provided. An increase in output current causes a corresponding increase in voltage across resistor R133, and therefore in the emitter-to-base voltage for transistor Q27. If output current *momentarily* becomes excessive, conduction through Q27 increases sufficiently to render Q23 and Q24 nonconducting, thereby decreasing output current.
2. Diode rectifiers CR10 and CR11, and filter capacitor C30. These elements, together with one center-tapped secondary of transformer T2 of the +15 Volt/—15 Volt Power Supply (Paragraph 7.3.4), constitute a floating power supply for the emitter-follower stage.
3. Offset-current generator, to provide the capability of an output compatible with a live-zero, current-type recorder.

   Distinguishing characteristic of the live-zero systems is that when input to the amplifier is zero, the signal applied to the *recorder* is not zero. Instead, it is equal to 20% of the recorder input current required for a fullscale deflection. Thus, zero-signal current is 1 ma for a 1 to 5 ma recorder, 4 ma for a 4 to 20 ma recorder, and 10 ma for a 10 to 50 ma recorder.

   The offset-current generator provides a choice of three constant currents. An exact —10 volts is applied to the base of Q20A by a network consisting of reference diode CR12 and associated resistors (R83, R84, R85, and R86), connected between ground and the —15 volt supply. The collector voltage of Q20B drives the base of Q21; the emitter of Q21 drives the base of Q22 to maintain the required voltage at the base of Q20B. Section S-9B of Recorder Milliampere Selector S9 selects the appropriate constant current by connecting the corresponding resistor: R86 for 1 ma, R87 for 4 ma, or R88 for 10 ma. (The *output-selection* function of S9 is performed by Section S9-A, described in Item 5, below.)
4. Live-Zero/Dead-Zero Selector: This combination of a multipin receptacle and an associated reversible plug constitutes a switch, labeled S10 on the current-output board. The orientation of the plug determines the electrical location of the recorder in the current-output circuit. Alternative choices are:

   a. The DEAD ZERO switch position (used only with a 0 to 5 ma recorder) connects the recorder between the emitter-follower output and the load resistance.

   b. The LIVE ZERO switch position (used with 1 to 5, 4 to 20, and 10 to 50 ma recorders) connects the recorder between ground and the negative terminal of the emitter-follower power supply.

5. Recorder Milliampere Selector: This combination of a multipin receptacle and an associated 4-position plug constitutes a switch, labeled S9 on the circuit board. The plug provides a choice of four outputs, to permit use of a current recorder with a fullscale span of 0 to 5, 1 to 5, 4 to 20, or 10 to 50 ma. Circuit parameters are such that, with the plug in the position appropriate to the particular recorder, a signal-voltage level of +5 volts at test point TP11 of the current-output board results in a fullscale recorder deflection.

7.3.4 THE +15 VOLT/—15 VOLT POWER SUPPLY (A.C. ANALYZERS ONLY)

The +15 Volt/—15 Volt Power Supply provides power for the electronic circuitry of *a.c.-operated analyzers.* (Power for the portable d.c. analyzer is normally provided by a +15 volt/—15 volt *battery pack.*)

As shown in Figure 9-9, power transformer T2 has two center-tapped secondaries, used as follows:

1. The 94-volt secondary drives a fullwave-rectifier circuit consisting of diodes CR13 and CR14, and filter capacitor C31. The d.c. output is applied, through resistor R96, to series-connected elements R94, R95, CR15, CR16, CR17, and CR18.

   The junction of CR18 and R94 is connected to circuit ground to provide two equal but opposite outputs: +15 volts and —15 volts with respect to ground. Shunt-type voltage-regulator circuits utilizing transistors Q25 and Q26 hold these outputs constant at the specified values.

   Both outputs are used by the amplifier board. In addition, the —15 volt output is used by the offset-current generator in the optional current-output board (Paragraph 7.3.3).

2. The 90-volt secondary drives a rectifier circuit consisting of diodes CR10 and CR11, and filter capacitor C30. The rectifier and filter components are on the optional current-output circuit board. The transformer winding and the associated circuit components constitute a floating power supply for the emitter-follower stage. Refer to Paragraph 7.3.3.

7.3.5 TEMPERATURE-REGULATION CIRCUIT (NON-PORTABLE AND SEMI-PORTABLE ANALYZERS ONLY)

In non-portable and semi-portable instruments, a thermostatically-controlled heater mounted adjacent to the flow controller maintains a constant temperature.

7.3.6 ALARM SET POINT ACCESSORY AND UNIVERSAL ALARM BOARD (OPTIONAL, FOR NON-PORTABLE AND SEMI-PORTABLE ANALYZERS ONLY)

The Alarm Set Point Accessory, Figure 9-11, and the Universal Alarm Board, Figure 9-12, are used in combination to provide the basis for various alarm and, or, control systems. Such systems are completed by the addition of appropriate, external, customer-supplied components, depending on the requirements of the application and the preferences of the user.

For versatility in use with diverse instruments, the Alarm Set Point Accessory incorporates two independent, adjustable, set-point circuits, designated "A" and "B." If both circuits are used, each drives a separate Universal Alarm Board. However, the *Trace Moisture Analyzer* uses only circuit "A" and a single Universal Alarm Board to provide the high-level alarm function.

SECTION EIGHT MAINTENANCE

Most maintenance of the Trace Moisture Analyzer involves the electrolytic cell. The following Paragraphs describe recommended maintenance procedures. For location of cell and associated holder in the particular instrument configuration, refer to appropriate illustration of Figures 2-5 through 2-9.

8.1 CARE OF THE ELECTROLYTIC CELL

To minimize absorption of moisture, the cell should be kept sealed. Never leave it open to air longer than absolutely necessary. Adherence to this practice will increase cell life, and will cause response time to be dependent primarily on the dryness of the gas-handling system external to the instrument.

8.2 REPLACING ELECTROLYTIC CELL

To replace the electrolytic cell:

1. Remove electrical power from analyzer.
2. Unscrew cell holder and remove cell. If cell is to be resensitized, use procedure of Paragraph 8.3.
3. Remove and discard old O-rings; replace with new ones.

NOTE

New O-rings should be installed whenever cell is replaced.

New O-rings are supplied with each replacement cell. O-rings are also obtainable separately under Beckman Part 834499 (two required).

4. Set replacement or resensitized cell in position. Tighten cell holder.
5. If, inadvertently, cell has been subjected to prolonged exposure to high moisture levels, repeat initial drydown procedure of Paragraph 4.1.
6. Make leak check of Paragraph 4.2.2. Analyzer is now ready for normal operation.

8.3 CLEANING AND RESENSITIZING ELECTROLYTIC CELL

To resensitize the electrolytic cell:

1. Using a syringe with needle removed, force about 10 cc of distilled water through cell.
2. With the empty syringe, force several successive volumes

of air through cell, to expel excess liquid. With laboratory tissue, wipe off cell fittings.

3. Replace cell in Trace Moisture Analyzer. With electrical power *off*, pass clean dry air or nitrogen through cell for about 2 hours. Then, turn Range Selector Switch to STDBY and continue drydown. As cell dries, turn Range Selector Switch to 1000 ppm, and then to successively lower positions until meter reads onscale on the desired range.
4. Remove cell from analyzer.
5. Measure resistance between electrical connectors on cell; if one megohm or greater, proceed to Step 6.

If resistance is less than 1 megohm, repeat Steps 1 through 4. If desired, a solvent such as alcohol may be substituted for distilled water. Again measure cell resistance; if now one megohm or greater, proceed to Step 6. A near-zero resistance that cannot be increased indicates a shorted cell which must be discarded. Install replacement cell as explained in Paragraph 8.2.

6. Draw 10 cc of 20% phosphoric acid solution into the syringe. With the syringe, force a small quantity of acid through the cell, being careful that acid does not contact the skin.
7. Repeat Steps 2 and 3.

SECTION NINE SERVICE

The most common symptoms of a malfunctioning analyzer are: subnormal or zero meter reading, Paragraph 9.1; offscale meter reading, Paragraph 9.2; and erratic meter reading, Paragraph 9.3.

As aids in servicing the electronic circuitry, refer to the appropriate schematic and pictorial wiring diagrams of Figures 9-1 through 9-13.

9.1 SUBNORMAL OR ZERO METER READING

The most probable causes of subnormal or zero meter readings are:

1. Lack of power-supply output voltage. To check, measure voltage. Zero voltage may be due to —
   a. Instrument is not plugged in, or is not turned on.
   b. Fuse is burned out.
2. Cell element has become coated with inert material, has been "poisoned" by sample gases, or has lost its desiccant film. Refer to Paragraph 8.3 for instructions in cell cleaning and resensitizing.

9.2 OFFSCALE METER READING

Possible causes of an offscale meter reading are:

1. Electrolytic cell is partially short-circuited. Remove cell. With an ohmmeter, measure resistance between cell terminals. Resistance should be 5,000 to 20,000 ohms or more; if less than this, clean and resensitize cell (per Paragraph 8.3) or replace it.
2. Moisture content of sample stream or sample-handling system exceeds 1000 ppm. Run dry nitrogen, cylinder gas, or other suitable dry gas through sampling system and analyzer to determine if instrument dries down properly. Meter should read onscale within 20 to 30 minutes.

9.3 ERRATIC METER READING

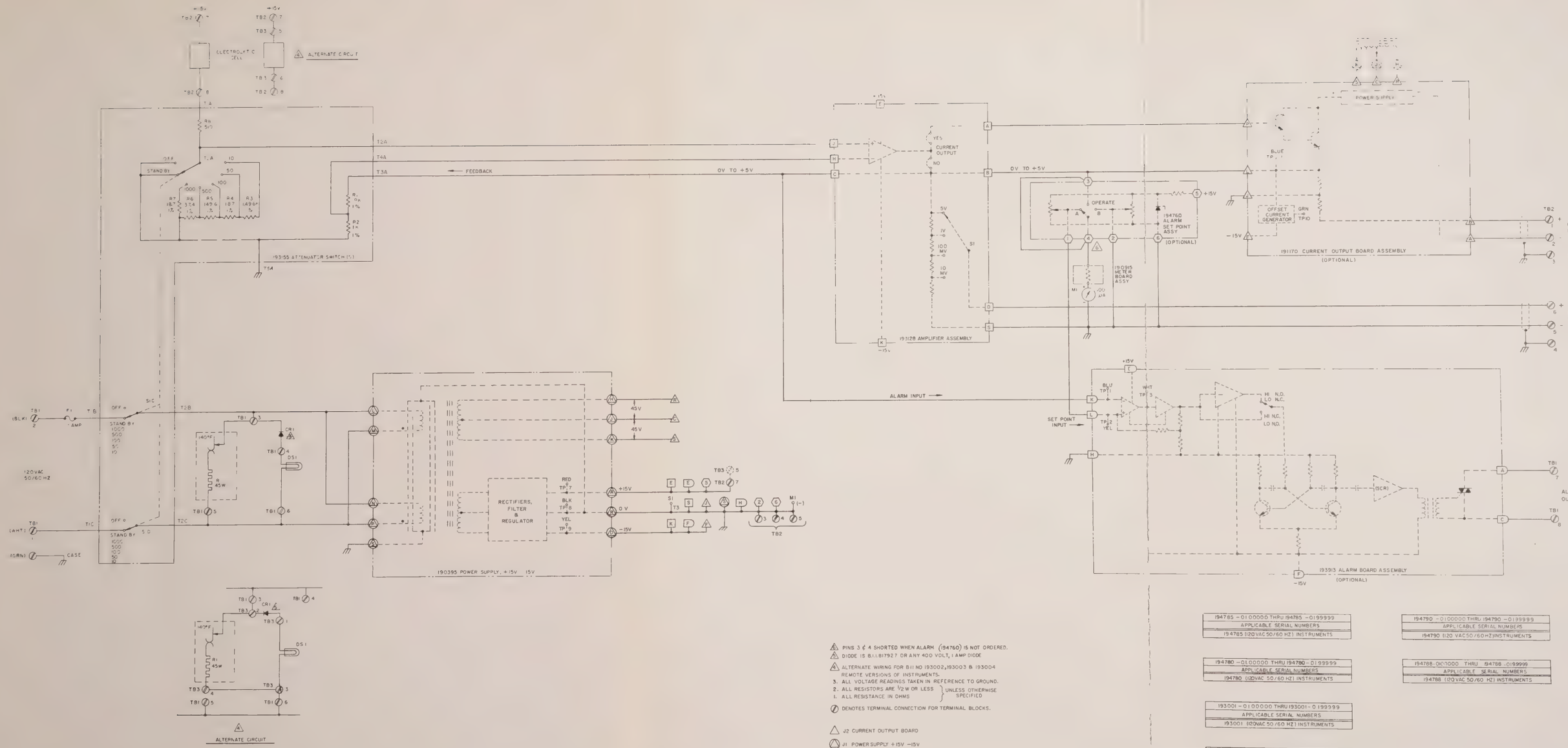
Erratic readings may be caused by any of the following factors:

1. Flow control is poor. Test as follows:
   a. Make leak check as explained in Paragraph 4.2.2.
   b. At instrument inlet, connect a suitable dry gas with a pressure regulator. Pressure should be variable from 10 to 100 psig.
   c. Bring pressure to 10 psig. Vary the Sample Flow Control Valve setting. Flow rate should be adjustable above and below 100 cc/minute.
   d. Bring pressure to 100 psig. Vary Sample Flow Control Valve setting. Flow rate should be adjustable above and below 10 cc/minute.
   e. Again bring pressure to 10 psig. Set flow rate to 100 cc/minute. Vary inlet pressure from 10 to 100 psig. Flow rate should not vary more than ±10 cc/minute.
   f. If flow control is unsatisfactory, clean flow controller.

NOTE

If Sample Flow Control Valve is damaged, install a new 631656 Flowmeter Needle Valve Replacement Kit.

2. Electrolytic cell is partially plugged. Remove and inspect cell; if plugged, clean it as directed in Paragraph 8.3.
3. Cell is partially short-circuited. Remove cell. With an ohmmeter, measure resistance between cell terminals. Resistance should be 5,000 to 20,000 ohms or more; if less than this, clean and resensitize cell (per Paragraph 8.3), or replace it.



△ PINS 3 & 4 SHORTED WHEN ALARM (194760) IS NOT ORDERED.
△ DIODE IS B.I.I. 81792 OR ANY 400 VOLT, 1 AMP DIODE
△ ALTERNATE WIRING FOR B.I.I. NO 193002, 193003 & 193004 REMOTE VERSIONS OF INSTRUMENTS.
3. ALL VOLTAGE READINGS TAKEN IN REFERENCE TO GROUND.
2. ALL RESISTORS ARE ½ W OR LESS } UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCE IN OHMS
⊘ DENOTES TERMINAL CONNECTION FOR TERMINAL BLOCKS.

△ J2 CURRENT OUTPUT BOARD
⬡ J1 POWER SUPPLY +15V -15V
⬡ J5 ALARM SET POINT ASSY.
▱ J3 ALARM BOARD
□ J4 AMPLIFIER BOARD

194785 -0100000 THRU 194785 -0199999
APPLICABLE SERIAL NUMBERS
194785 (120VAC 50/60 HZ) INSTRUMENTS

194790 -0100000 THRU 194790 -0199999
APPLICABLE SERIAL NUMBERS
194790 (120 VAC 50/60 HZ) INSTRUMENTS

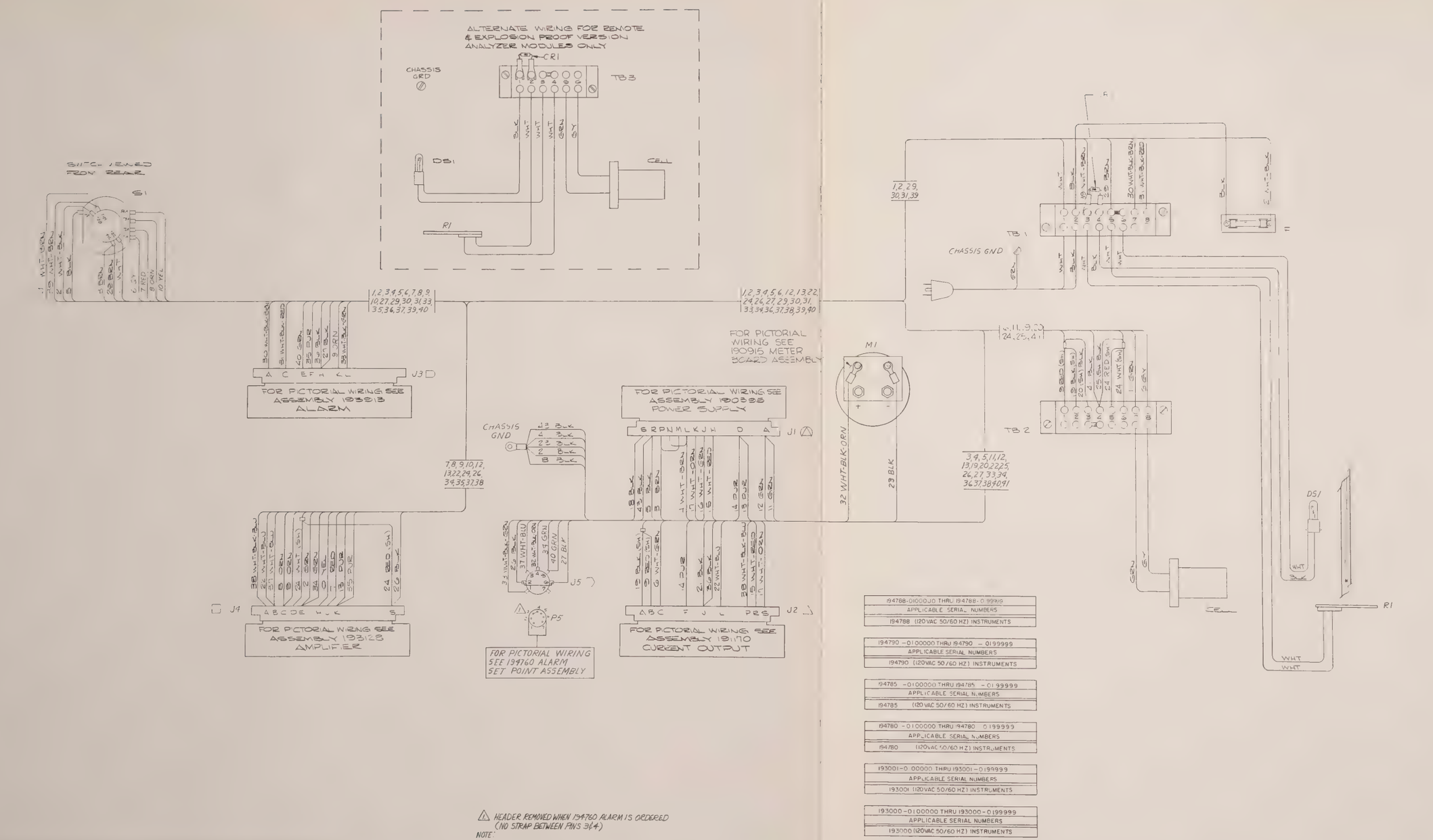
194780 -0100000 THRU 194780 -0199999
APPLICABLE SERIAL NUMBERS
194780 (120VAC 50/60 HZ) INSTRUMENTS

194788-0100000 THRU 194788 -0199999
APPLICABLE SERIAL NUMBERS
194788 (120 VAC 50/60 HZ) INSTRUMENTS

193001 -0100000 THRU 193001 -0199999
APPLICABLE SERIAL NUMBERS
193001 (120VAC 50/60 HZ) INSTRUMENTS

193000 -0100000 THRU 193000 -0199999
APPLICABLE SERIAL NUMBERS
193000 (120VAC 50/60 HZ) INSTRUMENTS

Figure 9-1. Schematic Wiring Diagram for Panel-Mounted/Semi-Portable, Remote-Control, and Explosion-Proof Analyzers



194788-0100000 THRU 194788-0199999
APPLICABLE SERIAL NUMBERS
194788 (120 VAC 50/60 HZ) INSTRUMENTS

194790 -0100000 THRU 194790 -0199999
APPLICABLE SERIAL NUMBERS
194790 (120 VAC 50/60 HZ) INSTRUMENTS

194785 -0100000 THRU 194785 -0199999
APPLICABLE SERIAL NUMBERS
194785 (120 VAC 50/60 HZ) INSTRUMENTS

194780 -0100000 THRU 194780 -0199999
APPLICABLE SERIAL NUMBERS
194780 (120 VAC 50/60 HZ) INSTRUMENTS

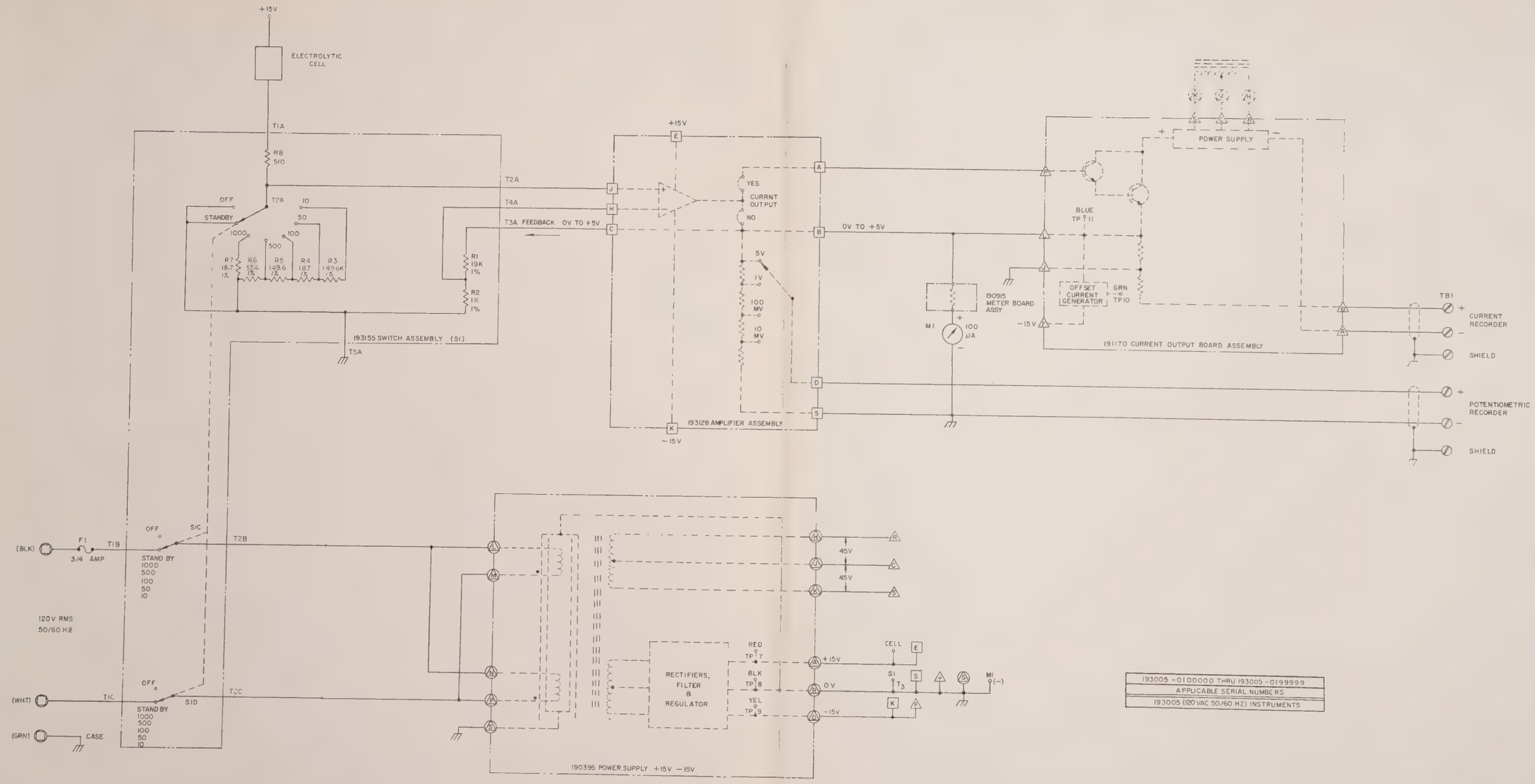
193001-0100000 THRU 193001-0199999
APPLICABLE SERIAL NUMBERS
193001 (120 VAC 50/60 HZ) INSTRUMENTS

193000-0100000 THRU 193000-0199999
APPLICABLE SERIAL NUMBERS
193000 (120 VAC 50/60 HZ) INSTRUMENTS

⚠ HEADER REMOVED WHEN 194760 ALARM IS ORDERED (NO STRAP BETWEEN PINS 3&4)

NOTE:

Figure 9-2. Pictorial Wiring Diagram for Panel-Mounted/Semi-Portable, Remote Control, and Explosion-Proof Analyzers



193005-0100000 THRU 193005-0199999
APPLICABLE SERIAL NUMBERS
193005 (120 VAC 50/60 HZ) INSTRUMENTS

P1 POWER RECEPTACLE

3. ALL VOLTAGE READINGS TAKEN IN REFERENCE TO GROUND.
2. ALL RESISTORS ARE ½W OR LESS
1. ALL RESISTANCE IN OHMS

} UNLESS OTHERWISE SPECIFIED

DENOTES TERMINAL CONNECTION FOR TERMINAL BLOCK

J1 CURRENT OUTPUT BOARD

J2 POWER SUPPLY +15V -15V

J3 AMPLIFIER BOARD

Figure 9-3. Schematic Wiring Diagram of Portable A.C. Analyzer

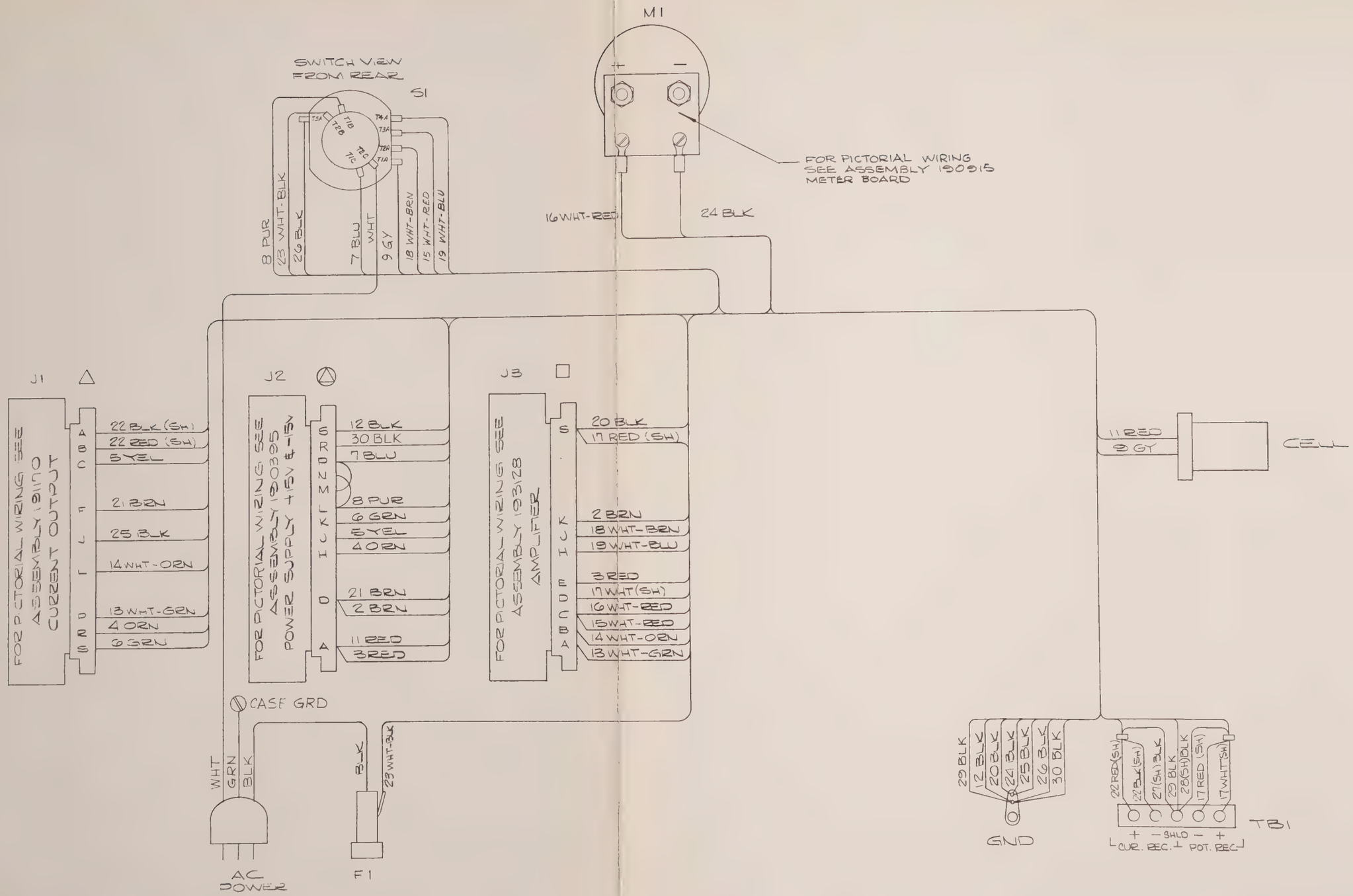
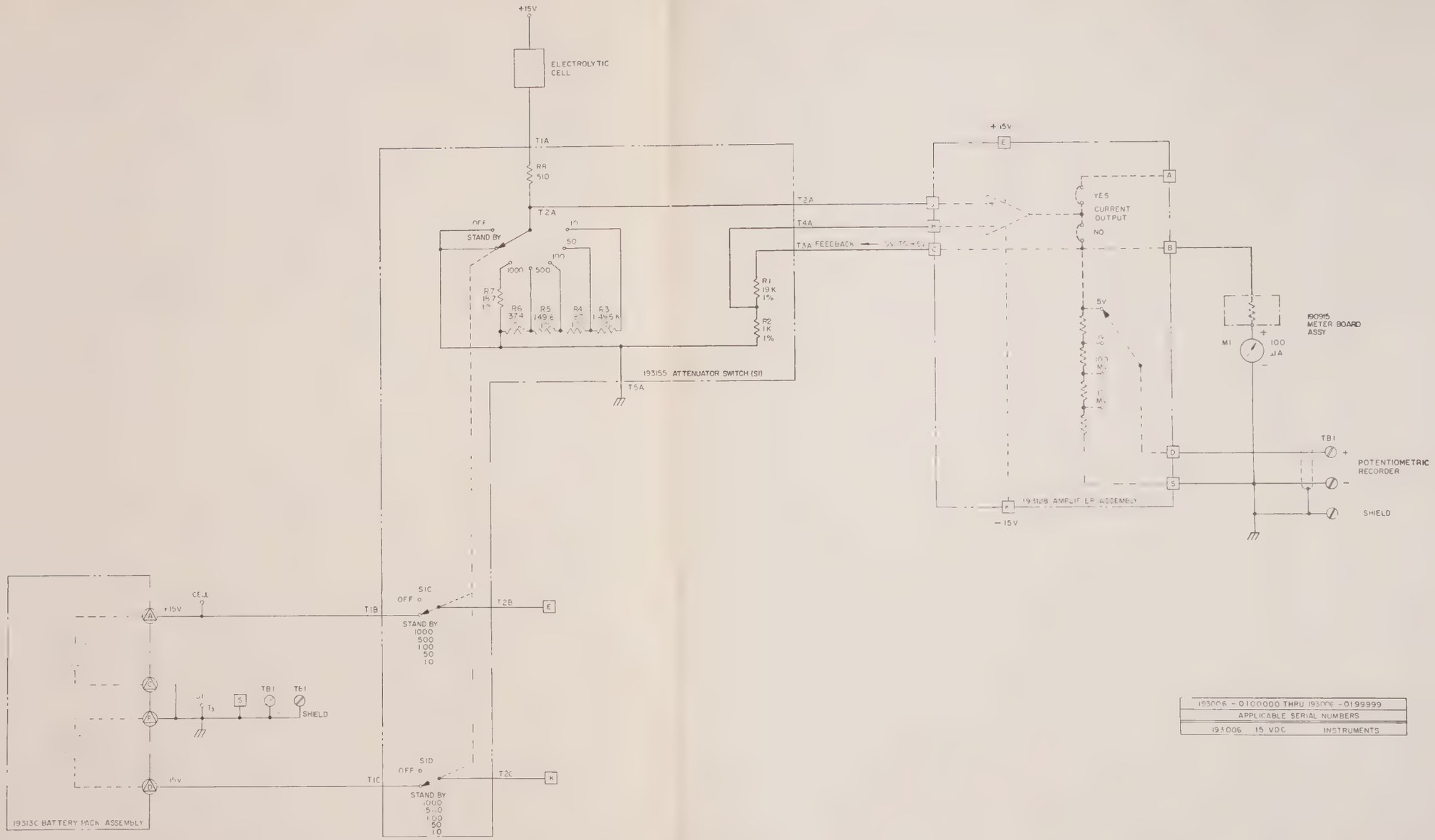


Figure 9-4. Pictorial Wiring Diagram of Portable A.C. Analyzer



193006 - 0100000 THRU 193006 - 0199999
APPLICABLE SERIAL NUMBERS
193006 15 VDC INSTRUMENTS

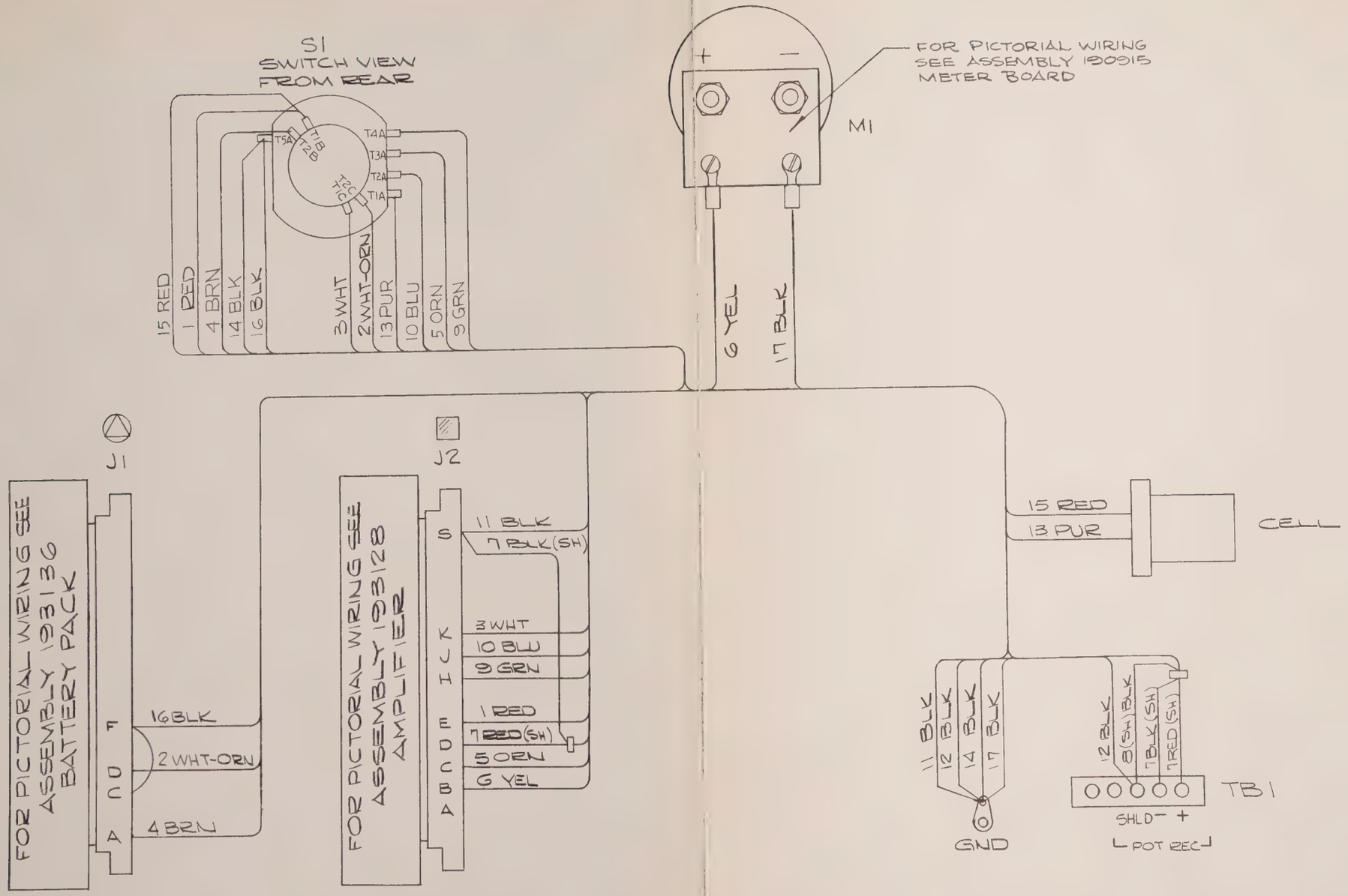
3. ALL VOLTAGE READINGS TAKEN IN REFERENCE TO GROUND
2. ALL RESISTORS ARE ½ W OR LESS } UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCE IN OHMS }

(A) DENOTES TERMINAL CONNECTION FOR TERMINAL BLOCK.

J1 POWER SUPPLY +15V −15V

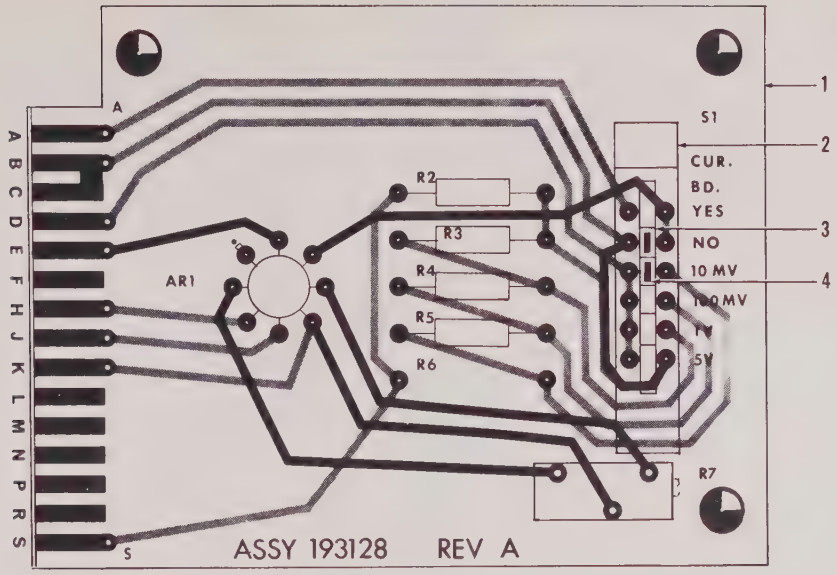
J2 AMPLIFIER BOARD

Figure 9-5. Schematic Wiring Diagram of Portable D.C. Analyzer

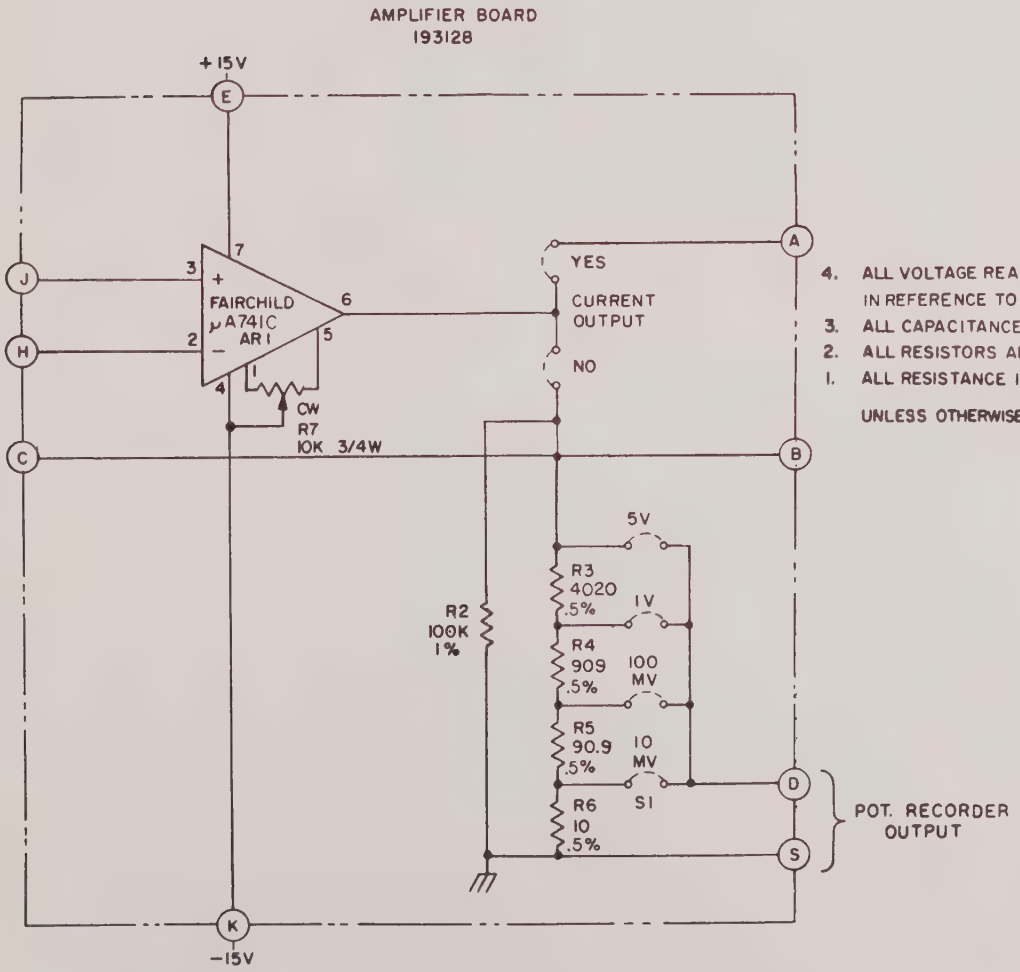


193006-0100000 THRU 193006-0199999
APPLICABLE SERIAL NUMBERS
193006 15 VDC INSTRUMENTS

Figure 9-6. Pictorial Wiring Diagram of Portable D.C. Analyzer



855-193128



4. ALL VOLTAGE READINGS TAKEN IN REFERENCE TO GROUND
3. ALL CAPACITANCE IN MICROFARADS
2. ALL RESISTORS ARE 1/2W OR LESS
1. ALL RESISTANCE IN OHMS

UNLESS OTHERWISE SPECIFIED

855-193128
Sht 2 of 3

Figure 9-7. Schematic and Pictorial Wiring Diagram of Amplifier Circuit Board (All Analyzers)

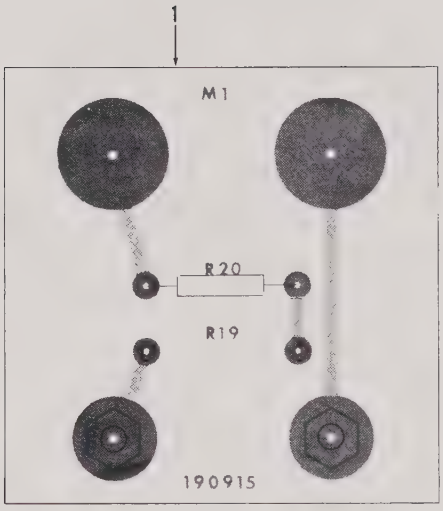


Figure 9-8. Pictorial Wiring Diagram of Meter Circuit Board (All Analyzers)

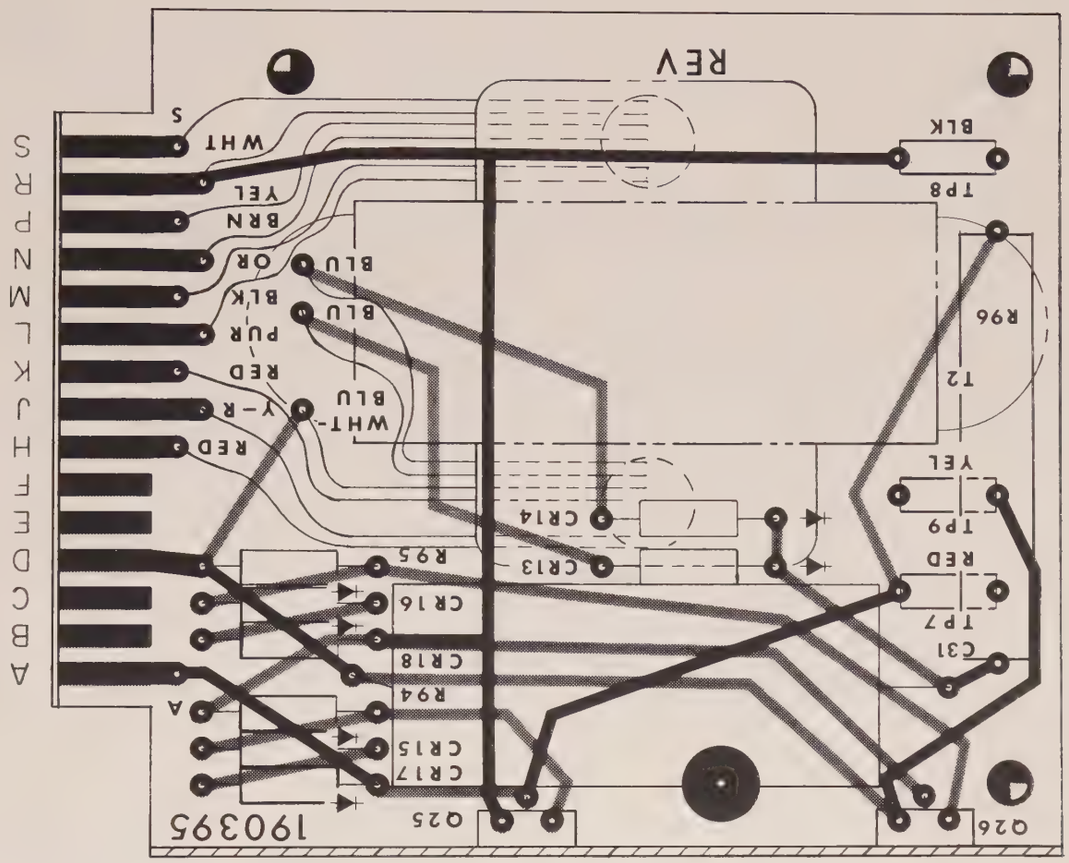
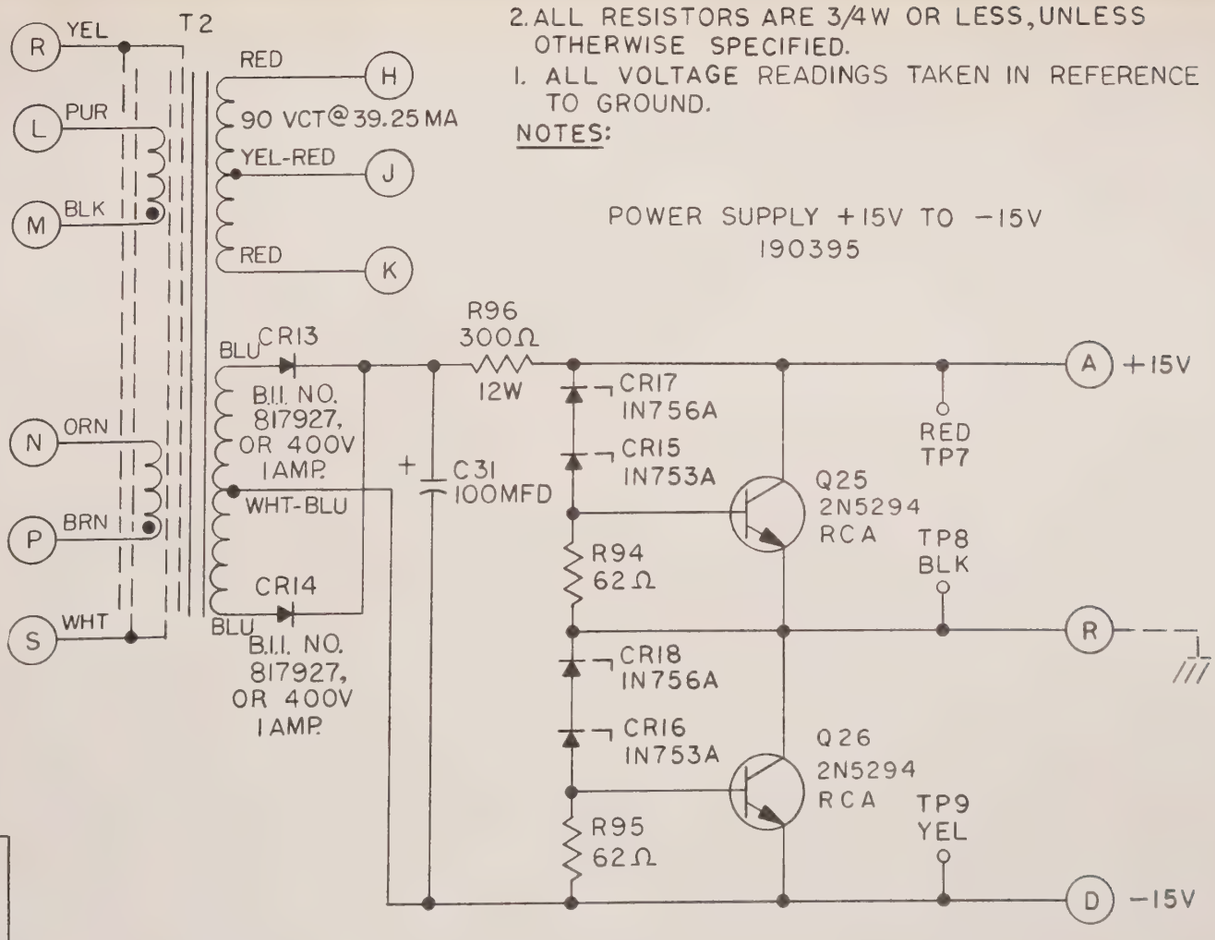


Figure 9-9. Schematic and Pictorial Wiring Diagrams of +15 Volt/−15 Volt Power Supply (A.C. Analyzers Only)

Sht 2 of 4 835-190395

835-190395



835-190395
SHT 3 OF 4

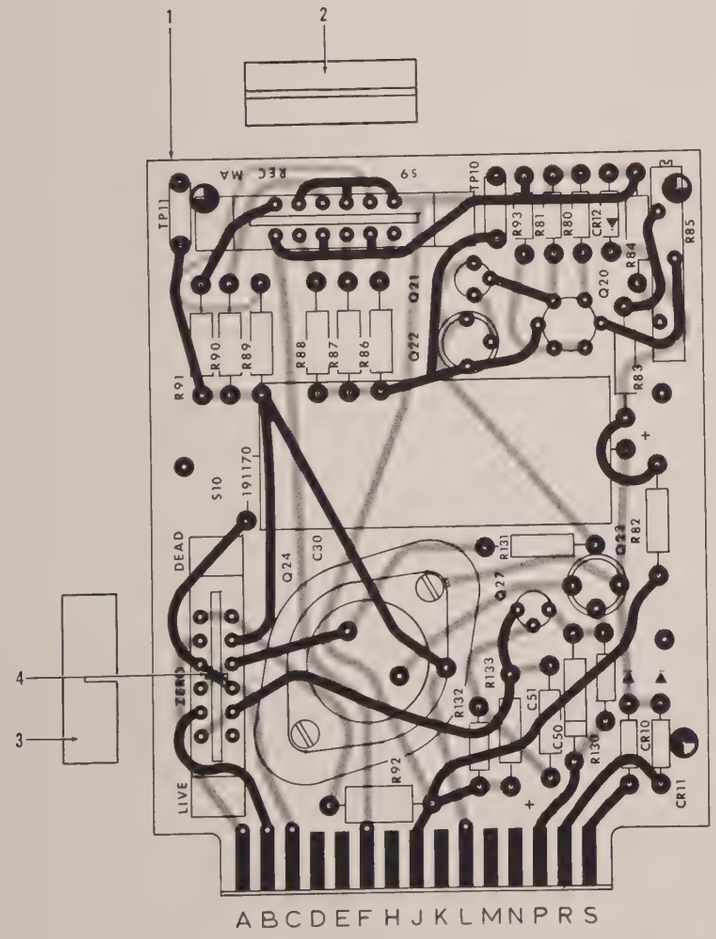
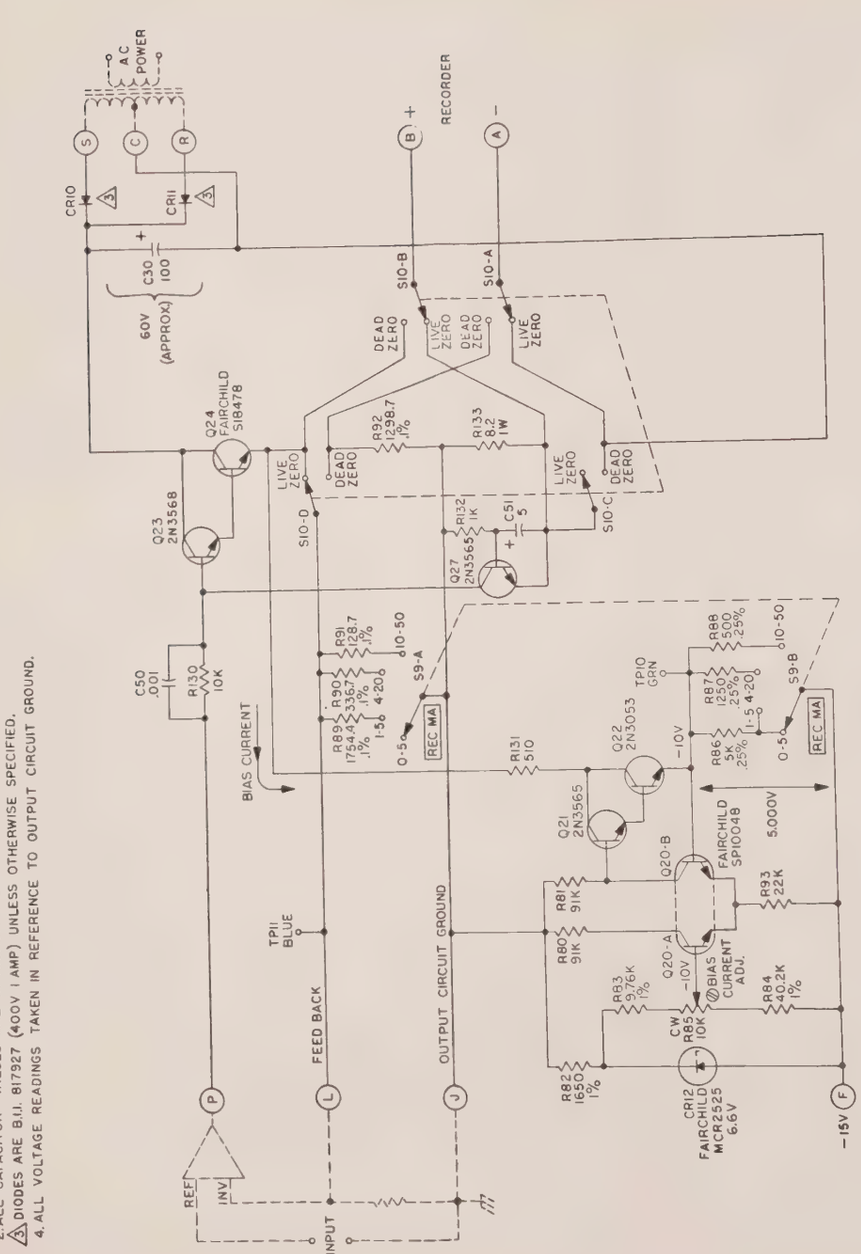
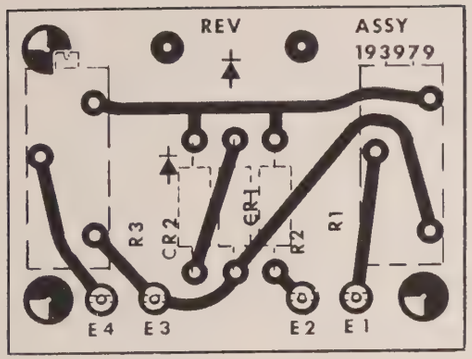


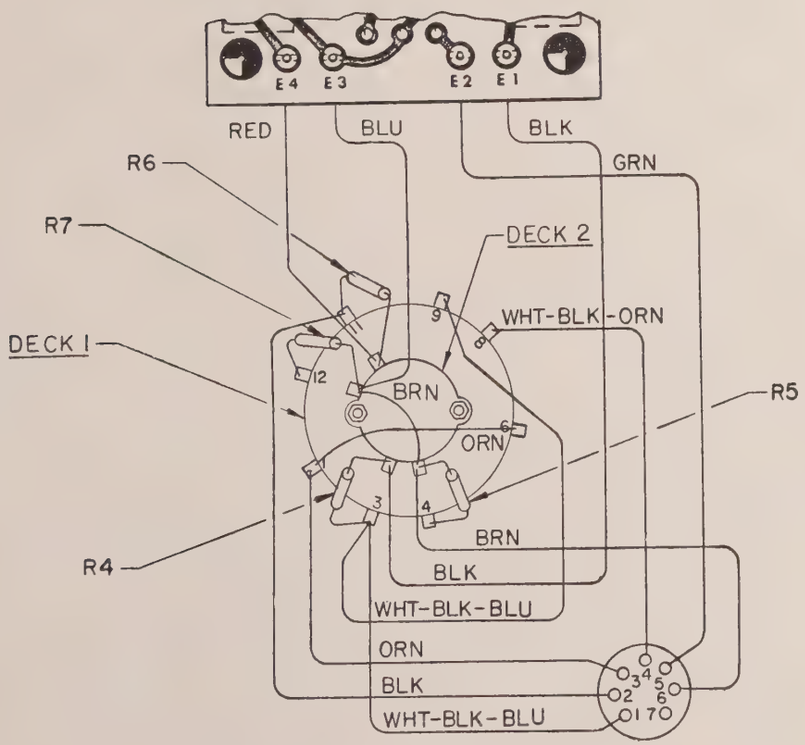
Figure 9-10. Schematic and Pictorial Wiring Diagrams of Current Output Circuit Board (Optional, for A.C. Analyzers Only)

1. ALL RESISTORS ARE 3/4W OR LESS AND VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
3. ⚠ DIODES ARE B.I.I. 817927 (400V 1 AMP) UNLESS OTHERWISE SPECIFIED.
4. ALL VOLTAGE READINGS TAKEN IN REFERENCE TO OUTPUT CIRCUIT GROUND.

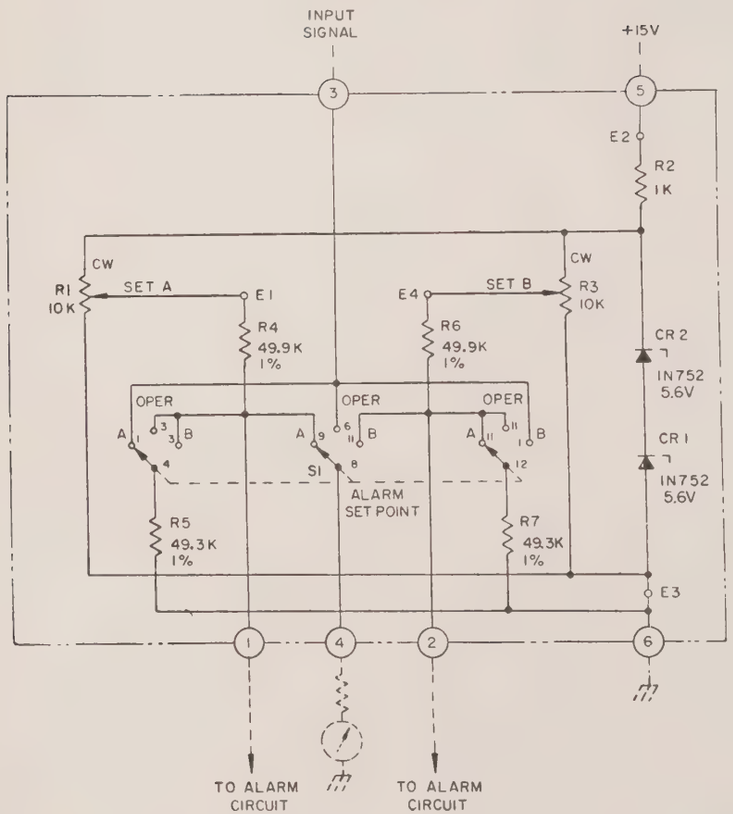


CURRENT OUTPUT BOARD
ASSY NO. 191170





ALARM SET POINT ASSEMBLY
194760



NOTES:
1. ALL RESISTORS ARE 1/2 W OR LESS
2. ALL RESISTANCE IN OHMS
3. ALL VOLTAGE READINGS TAKEN IN REFERENCE TO GROUND.

UNLESS OTHERWISE SPECIFIED

Figure 9-11. Schematic and Pictorial Wiring Diagrams of Alarm Set Point Assembly (Optional, for Non-Portable and Semi-Portable Analyzers Only)

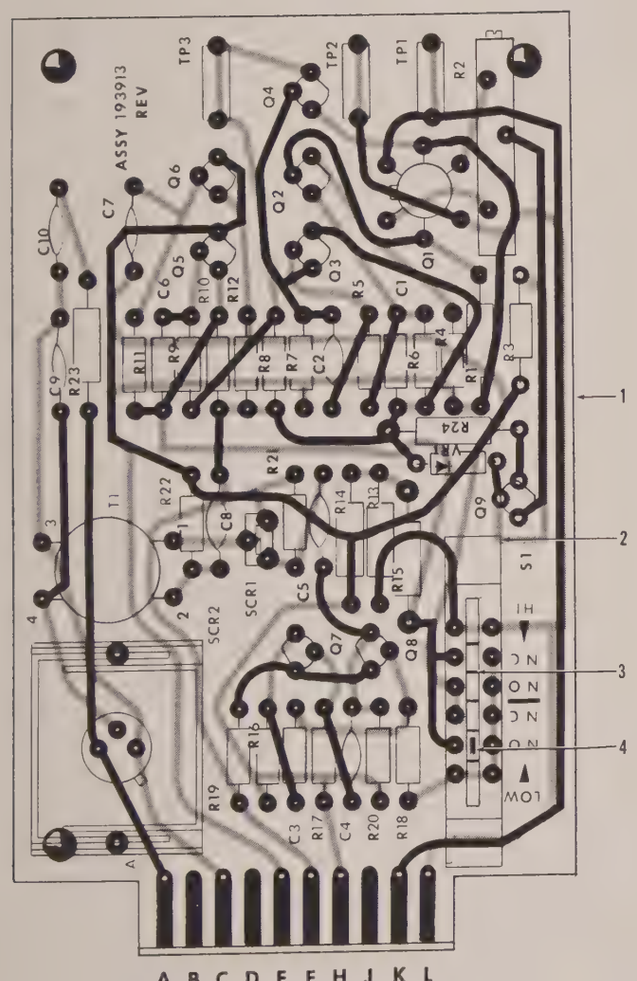
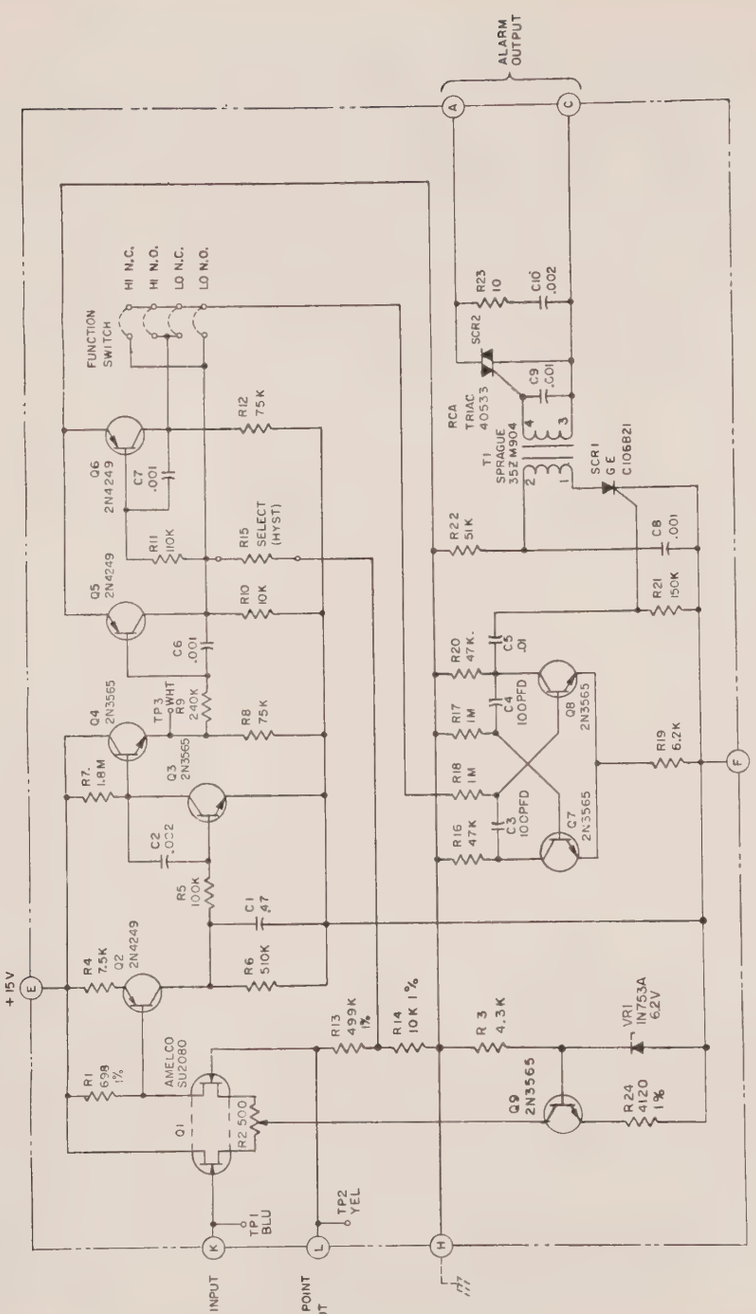
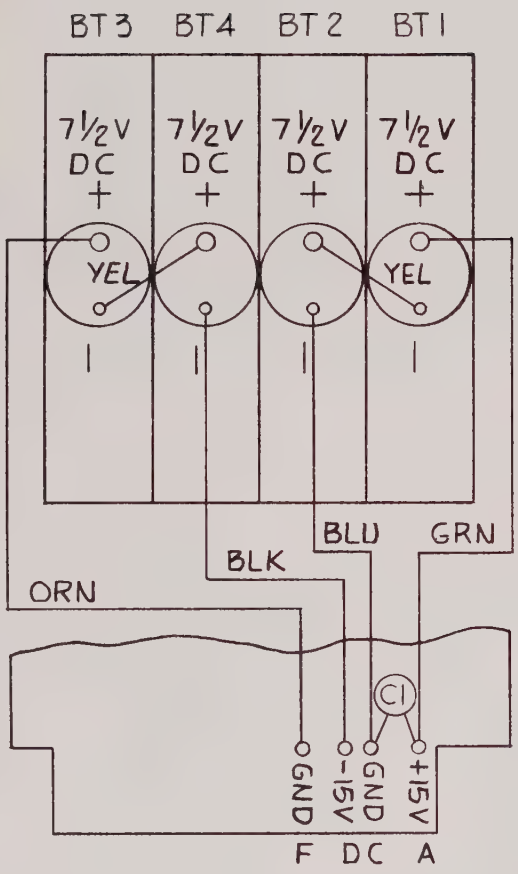
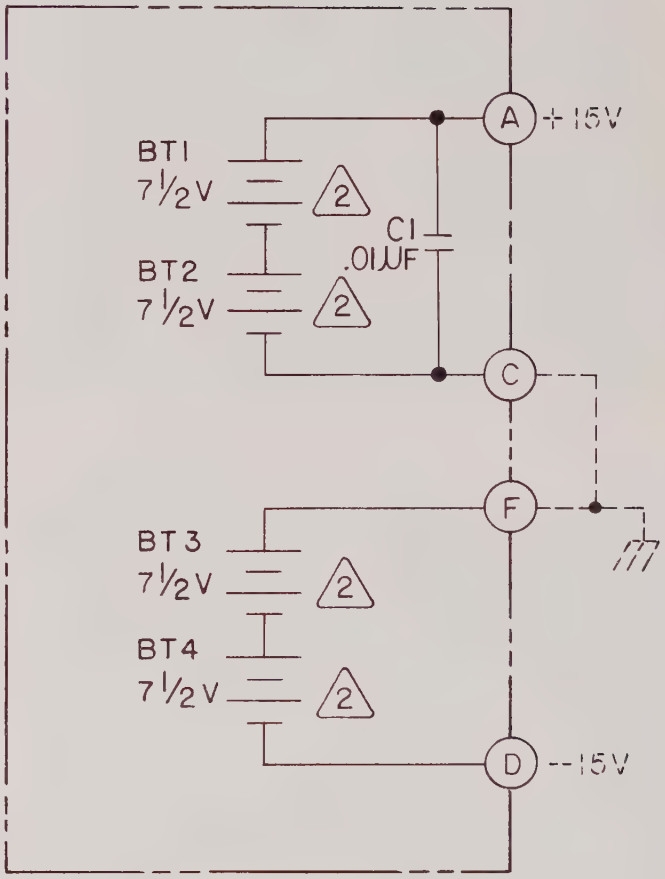


Figure 9-12. Schematic and Pictorial Wiring Diagrams of Universal Alarm Board (Optional, for Non-Portable and Semi-Portable Analyzers Only)







2 BATTERIES ARE 7½V D.C. BURGESS NO. B5.

1. ALL VOLTAGE READINGS TAKEN IN REFERENCE TO GROUND.

NOTES:

Figure 9-13. Schematic and Pictorial Wiring Diagrams of Battery Pack (Portable D.C. Analyzer Only)

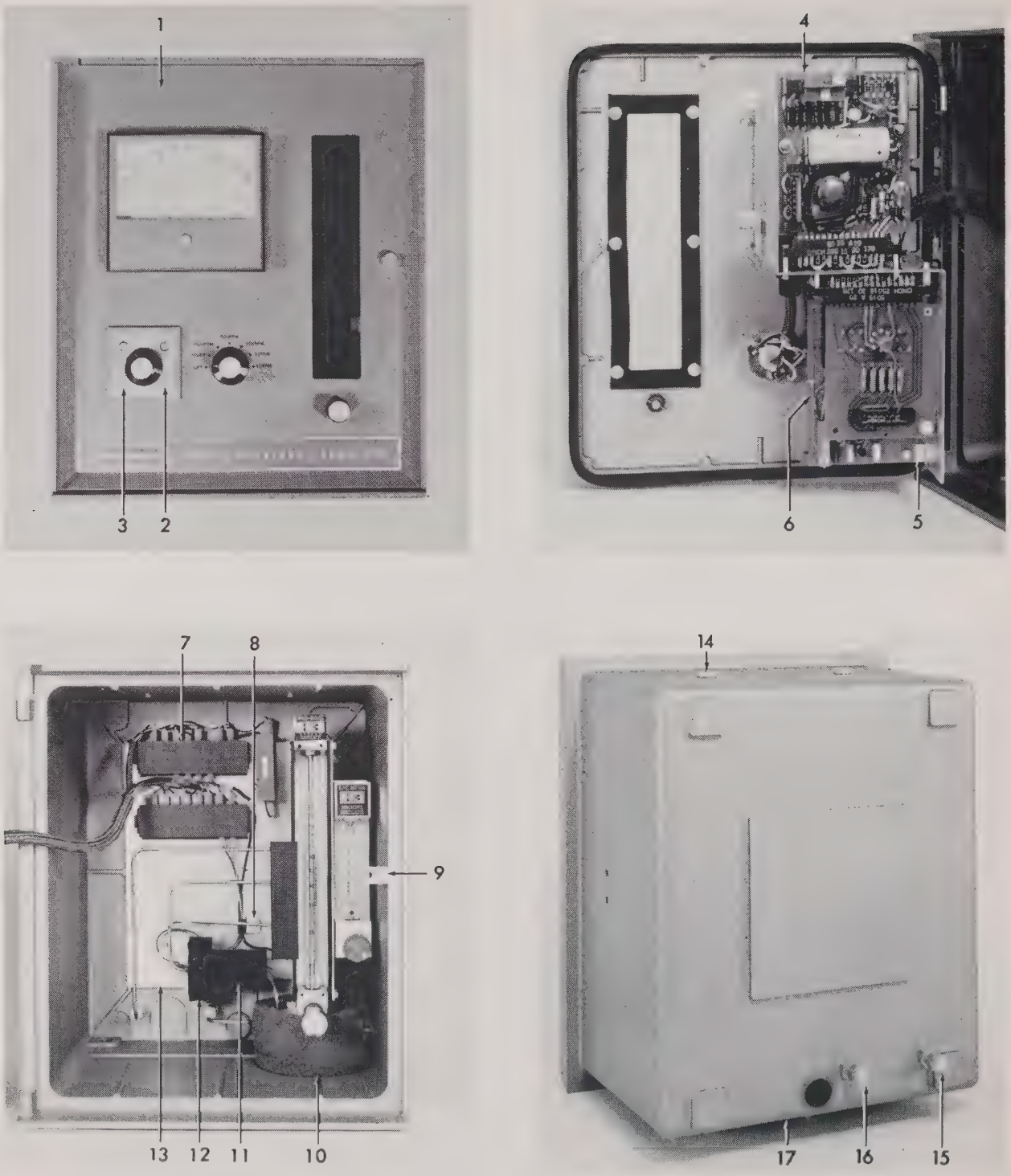
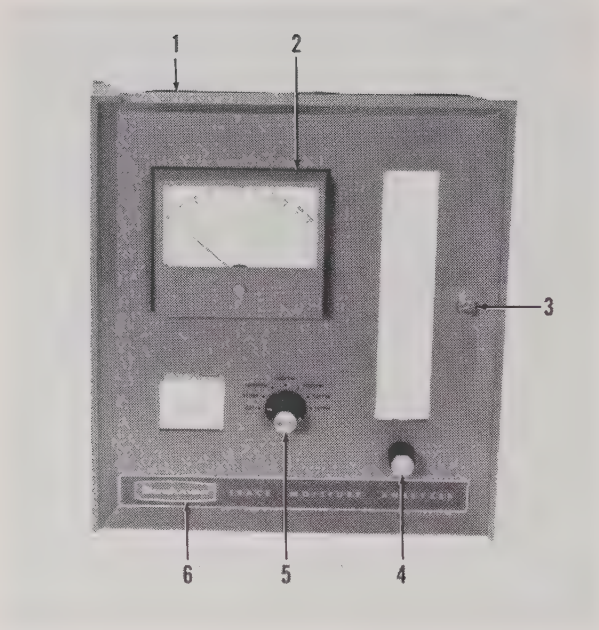


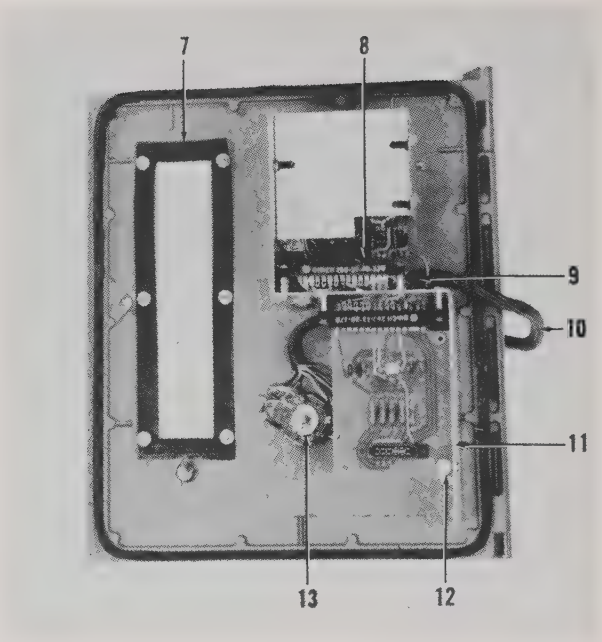
Figure 10-1. 193000 and 193001 Panel-Mounted/Semi-Portable Trace Moisture Analyzers

REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	SST 193000	193001
1		194782	Door Assy	1	1
			Attaching Parts:		
		101471	Washer	2	2
		827559	Washer, Nylon	2	2
2		194760	Alarm Set Point Assy	AS ORD	AS ORD
3		194729	Plate, Alarm	AR(1)	AR(1)
			Attaching Parts:		
		194730	Gasket	AR(1)	AR(1)
		194728	Clamp, Plate	AR(1)	AR(1)
		808591	Nut, Hex, 4-40	AR(2)	AR(2)
4		191170	Board Assy, Current Output	AS ORD	AS ORD
			Attaching Parts:		
		79224	Spacer	3	3
		809919	Screw, Pan Head, 6-32 x 1/2	3	3
		810690	Washer, Flat, No. 6	3	3
5		193171	Bracket, Alarm Bd.	1	1
			Attaching Parts:		
		809916	Screw, Pan Head, 6-32 x 1/4	1	1
		808266	Washer, Split, No. 6	1	1
6		193913	Board, Universal Alarm	AS ORD	AS ORD
			Attaching Parts:		
		809916	Screw, Pan Head, 6-32 x 1/4	1	1
		810690	Washer, Flat, No. 6	1	1
		808595	Nut, Hex, 6-32	1	1
7		190371	Shield, Terminal	2	2
8		499	Clamp, Cable	1	1
			Attaching Parts:		
		809917	Screw, Pan Head, 6-32 x 5/16	1	1
		79347	Washer, Cable Clamp	1	1
9		190357	Bracket, Door Lock	1	1
			Attaching Parts:		
		804391	Screw, Pan Head, 6-32 x 3/8	2	2
		808266	Washer, Split, No. 6	2	2
10		194734	Insulator	1	1
11		193190	Cell Assy	1	1
12		194725	Holder, Cell	1	1
13		194777	Chassis Assy, Panel Mtd	1	0
		194778	Chassis Assy, Panel Mtd	0	1
			Attaching Parts:		
		809916	Screw, Pan Head, 6-32 x 1/4	3	3
		808266	Washer, Split, No. 6	3	3
		810690	Washer, Flat, No. 6	3	3
14		866487	Screw, Pan Head, 5/16-18-1/4	2	2
15		811791	Fitting, Bulkhead	2	0
		29700	Fitting, Bulkhead	0	2
			Attaching Part:		
		802193	Washer, Int Tooth	2	2
16		856755	Filter	1	1
17		193180	Case, Machined	1	1
		630194	Cord Assy, Power	AS ORD	AS ORD

193000, 193001 Trace Moisture Analyzer, Panel Mounted

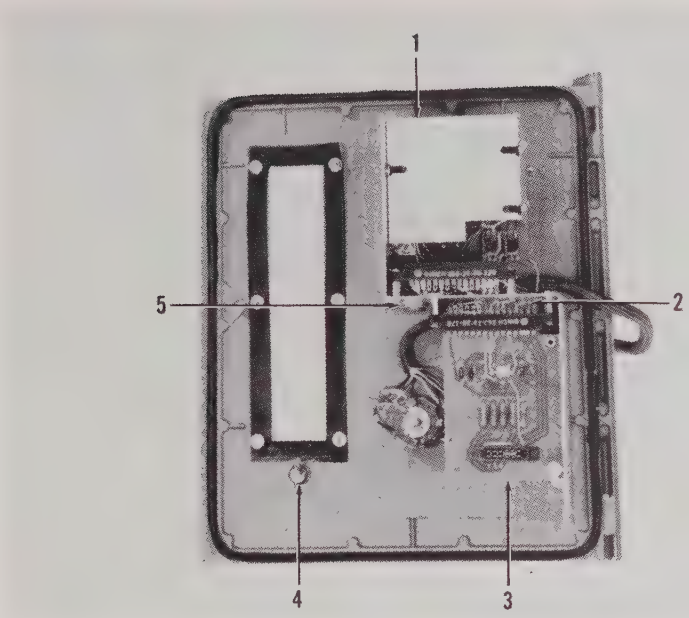
Figure 10-1. (2 of 2)





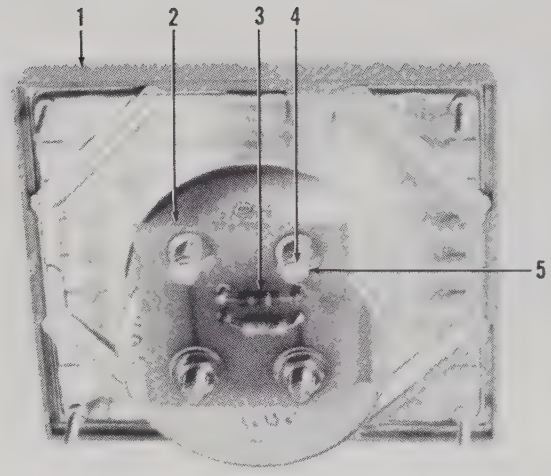
REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		193152	Door, Machined	
2		194781	Meter Assy	
			Attaching Part:	
		95845	Gasket, Meter	
3		190889	Screw, Door Lock	
			Attaching Parts:	
		802651	Washer, Nylon	
		17575	Ring, Retaining	
4		816808	Knob, Round	
5		816816	Knob, Round	
6		194746	Nameplate	
7		193169	Window	
			Attaching Parts:	
		194764	Gasket, Window	
		810690	Washer, Flat, No. 6	(6)
		808595	Nut, Hex, 6-32	(6)
8	J1,2, 4	823481	Connector, 15 Pin	(3)
			Attaching Parts:	
		809233	Spacer, Threaded	(6)
		809890	Screw, Pan Head, 4-40 x 1/4	(6)
		808264	Washer, Split, No. 4	(6)
		809892	Screw, Pan Head, 4-40 x 3/8	(6)
9		596	Clamp, Cable	(2)
			Attaching Parts:	
		804391	Screw, Pan Head, 6-32 x 3/8	(2)
		79347	Washer, Cable Clamp	(2)
10		194756	Harness	
11		193154	Chassis , Door	
			Attaching Parts:	
		810690	Washer, Flat, No. 6	(4)
		808266	Washer, Split, No. 6	(4)
		808595	Nut, Hex, 6-32	(4)
12		193170	Bracket, Support	
			Attaching Parts:	
		804391	Screw, Pan Head, 6-32 x 3/8	
		810690	Washer, Flat, No. 6	
		808266	Washer, Split, No. 6	
		808595	Nut, Hex, 6-32	
13	S1	193155	Switch, Attenuator	

Figure 10-2. 194782 Panel-Mounted Door Assembly



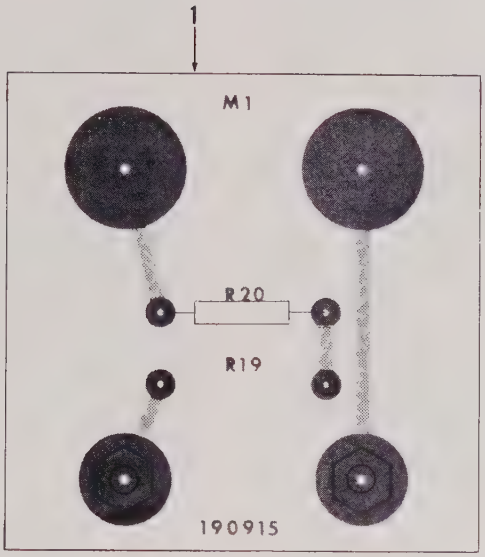
REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		190395	Power Supply Assy	
			Attaching Parts:	
		809943	Screw, Pan Head, 8-32 x 3/8	(2)
		802137	Washer, Flat, No. 8	(2)
		808268	Washer, Split, No. 8	(2)
2	J3	815702	Connector, 10 Pin	
			Attaching Parts:	
		809233	Spacer, Threaded	(2)
		809890	Screw, Pan Head, 4-40 x 1/4	(2)
		808264	Washer, Split, No. 4	(2)
		809892	Screw, Pan Head, 4-40 x 3/8	(2)
3		193128	Board Assy, Amplifier	
			Attaching Parts:	
		804391	Screw, Pan Head, 6-32 x 3/8	
		808266	Washer, Split, No. 6	
		810690	Washer, Flat, No. 6	
		808595	Nut, Hex, 6-32	
4		193178	Shaft Assy, Flowmeter	
			Attaching Parts:	
		5694	Bushing, Threaded	
		12676	Seal	
5		816673	Socket	
			Attaching Parts:	
		809889	Screw, Pan Head, 4-40 x 3/16	(2)
		808264	Washer, Split, No. 4	(2)
		808594	Nut, Hex, 4-40	(2)
		6819	Header, 7 Pin	
		14143	Cap	

Figure 10-3. 194782 Panel-Mounted Door Assembly (Internal View)



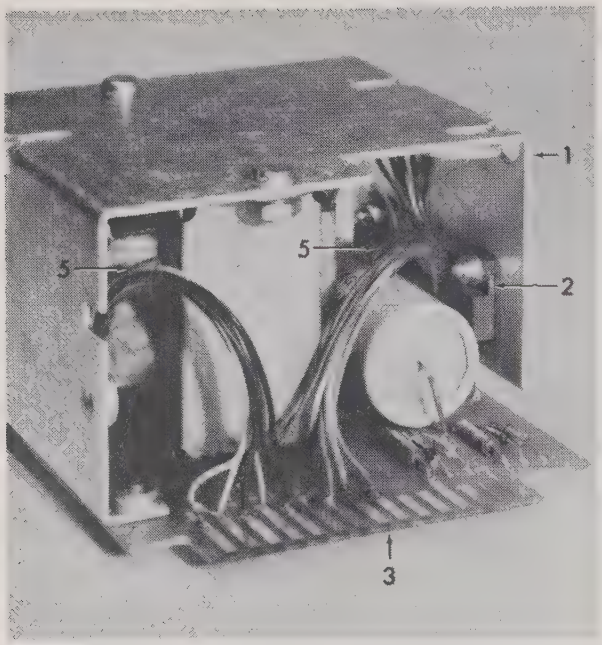
REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		190886	Meter	
2		190915	Board Assy	
3	R19	------	Resistor, Selected, ±5%, 1/2 W	
4		809916	Screw, Pan Head, 6-32 x 1/4	(2)
5		808266	Washer, Split, No. 6	(2)

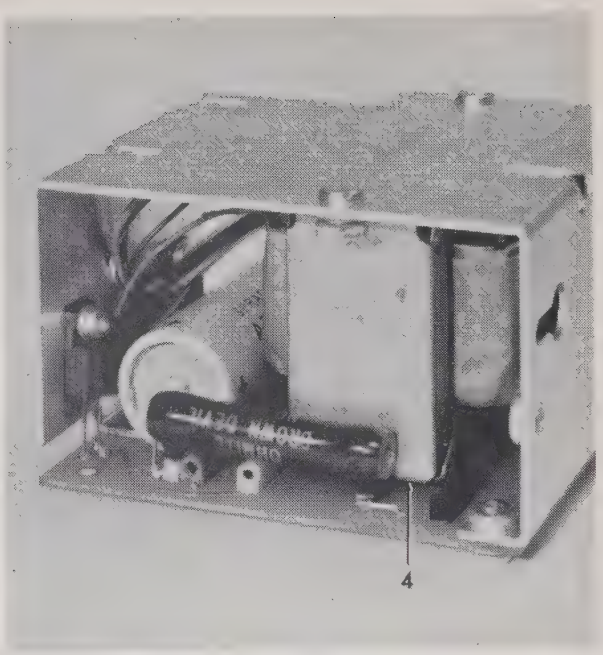
Figure 10-4. 194781 Meter Assembly



REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		190916	Board, Printed Circuit	
	R20	810597	Resistor, 47.5K, ±1%, 1/8 W	

Figure 10-5. 190915 Meter Board Assembly





REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		194596	Heatsink	
2	Q25, Q26	856963	Transistor, 2N5294	(2)
			Attaching Parts:	
		809891	Screw, Pan Head, 4-40 x 5/16	(2)
		808264	Washer, Split, No. 4	(2)
		808594	Nut, Hex, Sm Patt 4-40	(2)
		811756	Washer, Flat, No. 4	(4)
		871259	Bushing	(2)
		871260	Insulator, Mica	(2)
3		194594	Board Assy	
			Attaching Parts:	
		809917	Screw, Pan Head, 6-32 x 5/16	(3)
		808266	Washer, Split, No. 6	(3)
		810690	Washer, Flat, No. 6	(3)
4	T2	190542	Transformer, Power	
			Attaching Parts:	
		809942	Screw, Pan Head, 8-32 x 5/16	(2)
		808268	Washer, Split, No. 8	(2)
		802248	Nut, Hex, 8-32	(2)
5		45-037-23	Tubing, Clear	(AR)

Figure 10-6. 190395 Power Supply Assembly (±15-Volt)

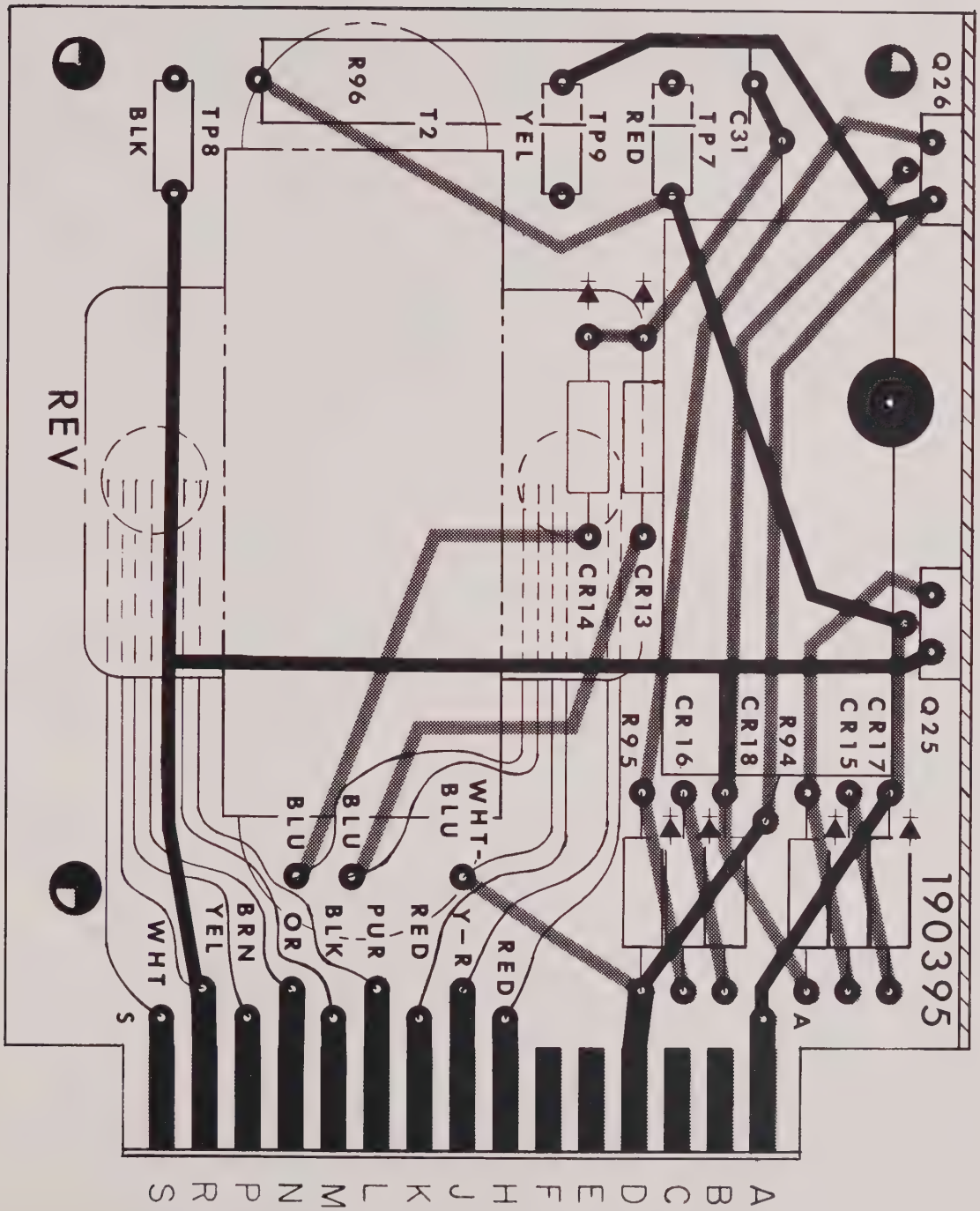


Figure 10-6. (2 Of 3)

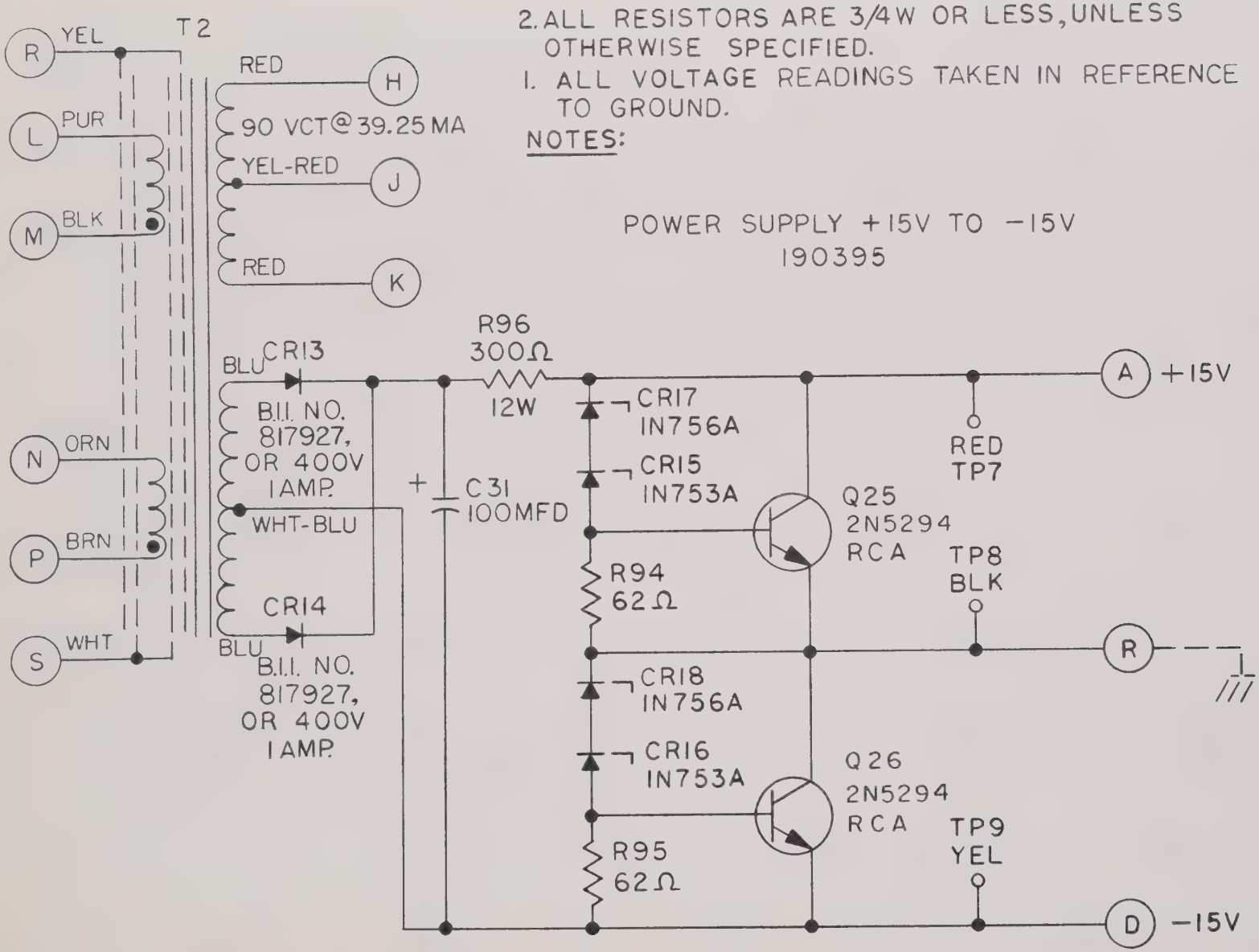
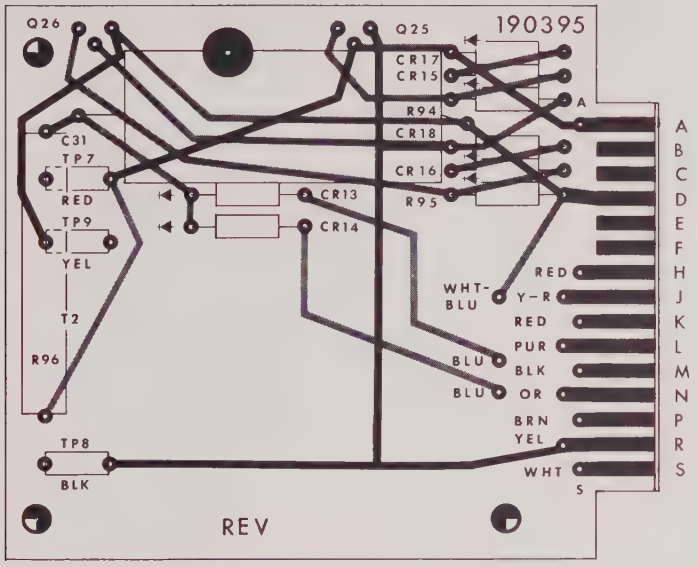


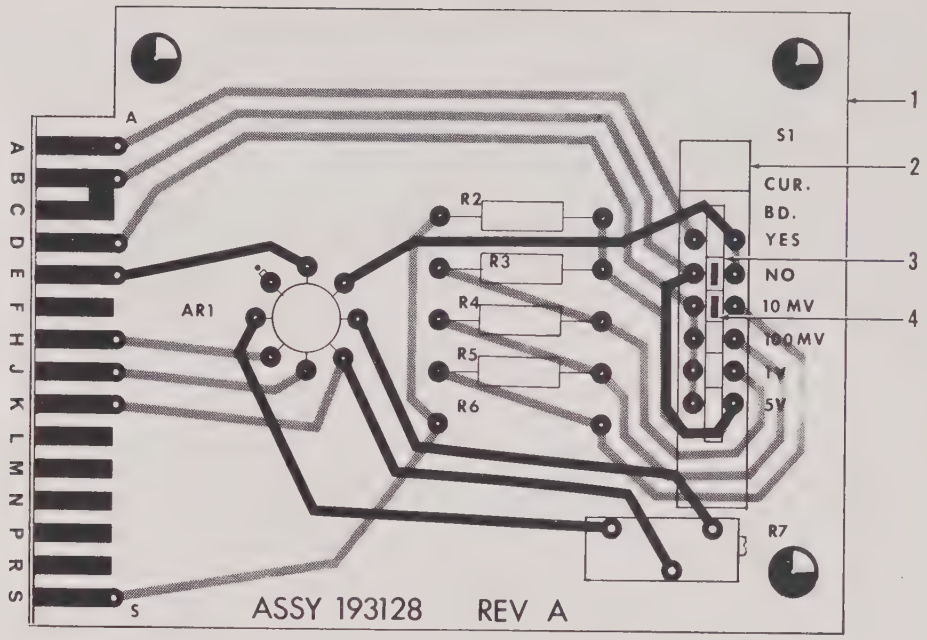
Figure 10-6. (3 Of 3)



REF CIR NO.	BECKMAN PART NO.	DESCRIPTION	QTY
	194593	Board, Printed Circuit	
R94, R95	15437	Resistor, 62 Ohms, ±5%, 1/2 Watt	(2)
R96	856029	Resistor, 300 Ohms, ±5%, 12 Watt	
C31	816768	Capacitor, 100 MFD 150 Volts	

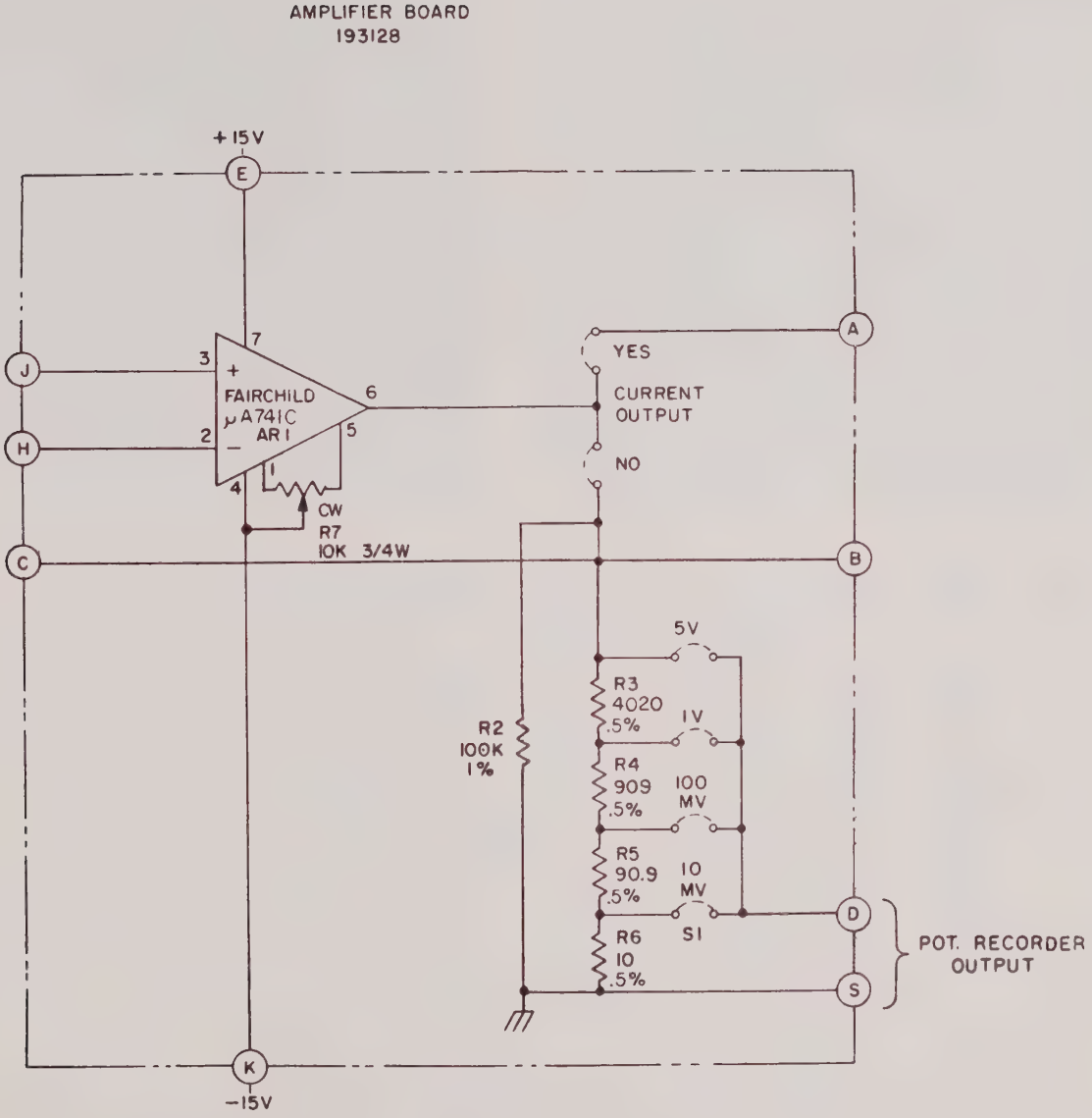
REF CIR NO.	BECKMAN PART NO.	DESCRIPTION	QTY
CR13, CR14	817927	Diode	(2)
CR15, CR16	822858	Diode, 1N753A	(2)
CR17, CR18	832774	Diode, 1N756A	(2)
TP7	806921	Jack, Test - Red	
TP8	810280	Jack, Test - Black	
TP9	810282	Jack, Test - Yellow	

Figure 10-7. 194594 Power Supply Board



REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		193127	Board, Printed Wiring	
2	S1	844514	Connector, 6 Pin	
3		845048	Key	(5)
4		190382	Pin	(2)
	AR1	866034	Amplifier, Fairchild, #uA741C	
	R2	805728 S	Resistor, 100K, ±1%, 1/2 W	
	R3	833869	Resistor, 4020 Ohms, ±.5%, 1/8 W	
	R4	866083	Resistor, 909 Ohms, ±.5%, 1/8 W	
	R5	866084	Resistor, 90.9 Ohms, ±.5%, 1/8 W	
	R6	866082	Resistor, 10 Ohms, ±.5%, 1/8 W	
	R7	854387	Resistor, Variable, 10K, ±10%, 3/4 W	

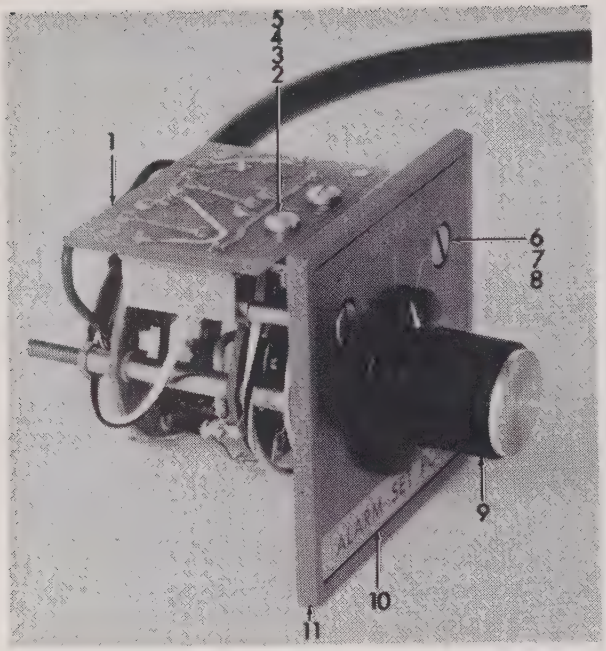
Figure 10-8. 193128 Amplifier Board

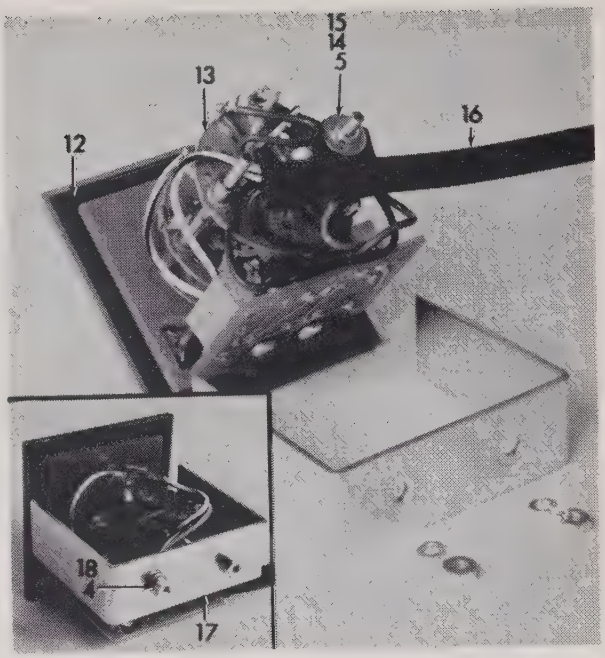


4. ALL VOLTAGE READINGS TAKEN IN REFERENCE TO GROUND
3. ALL CAPACITANCE IN MICROFARADS
2. ALL RESISTORS ARE 1/2W OR LESS
1. ALL RESISTANCE IN OHMS

UNLESS OTHERWISE SPECIFIED

Figure 10-8. (2 Of 2)





ITEM NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		193979	Board Assy, Set Point	1
2		809892	Screw, Pan Head, 4-40 x 3/8	2
3		811756	Washer, Flat, No. 4	2
4		808264	Washer, Lock, No. 4	4
5		808594	Nut, Hex, 4-40	3
6		193161	Pin, Adjustment	2
7		10426	O-Ring	2
8		801459	Retaining Ring	2
9		816816	Knob, Round	1
10		193163	Panel, Alarm	1
11		193156	Plate, Cast	1
12		194730	Gasket	1
13	S2	193162	Switch, Alarm	1
14		79347	Washer, Cable Clamp	1
15		3343	Clamp, Cable	1
16		194755	Harness, Alarm	1
17		194726	Bracket, Support	1
18		808591	Nut, Hex, 4-40	2
	R4,6	810963	Resistor, 49.9 K ±1%, 1/8 W	2
	R5,7	800657	Resistor, 49.3 K ±1%, 1/4 W	2

Figure 10-9. 194760 Alarm Setpoint Assembly

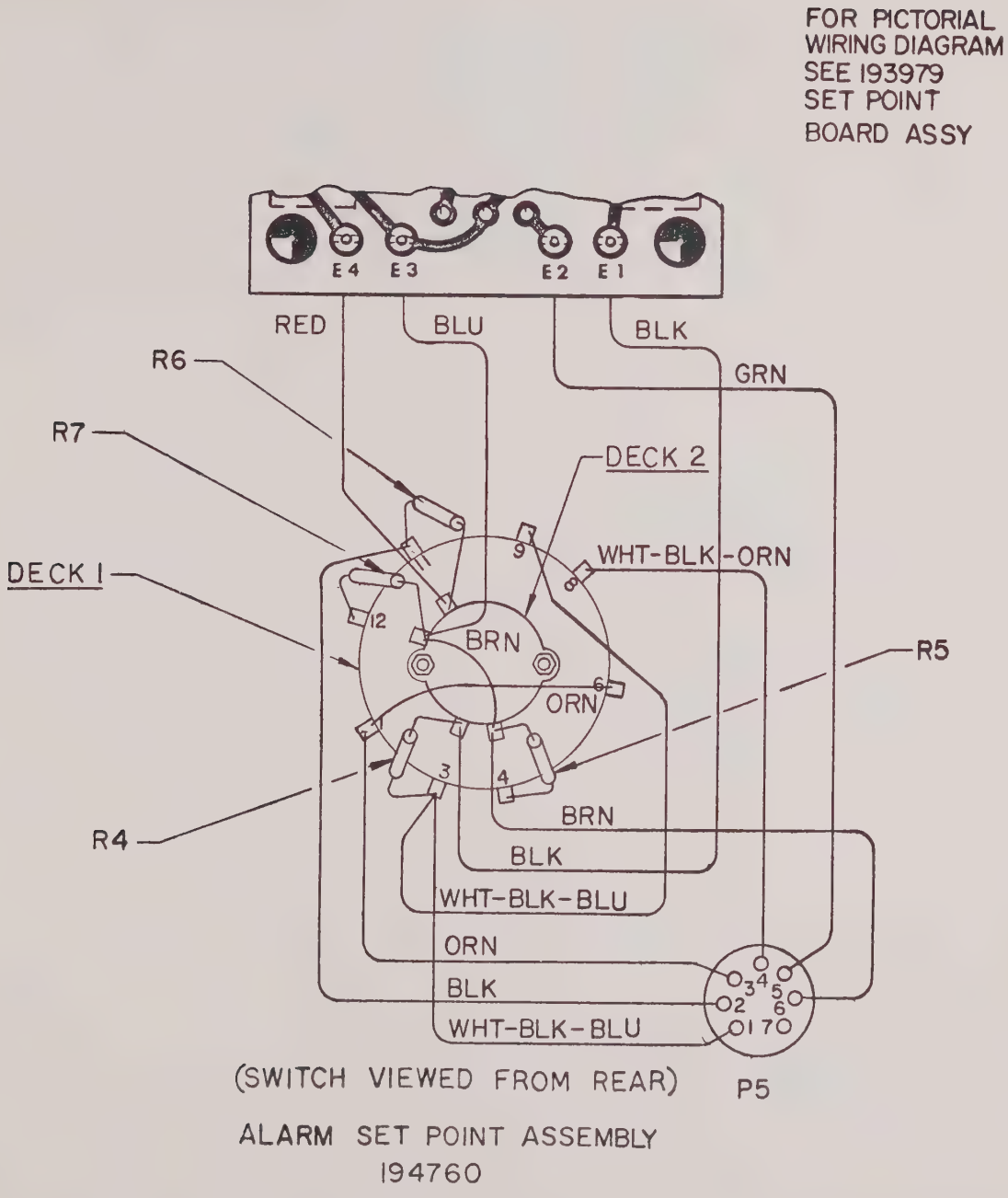
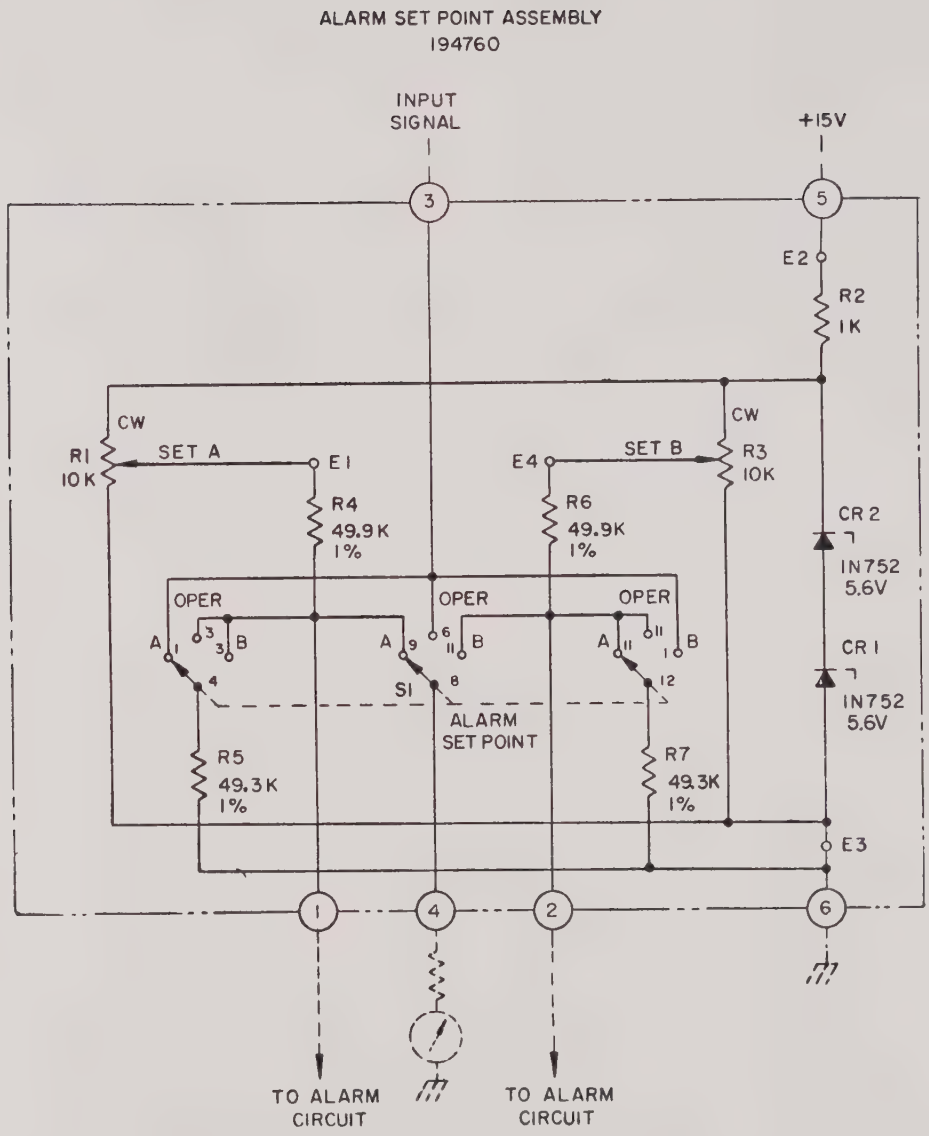
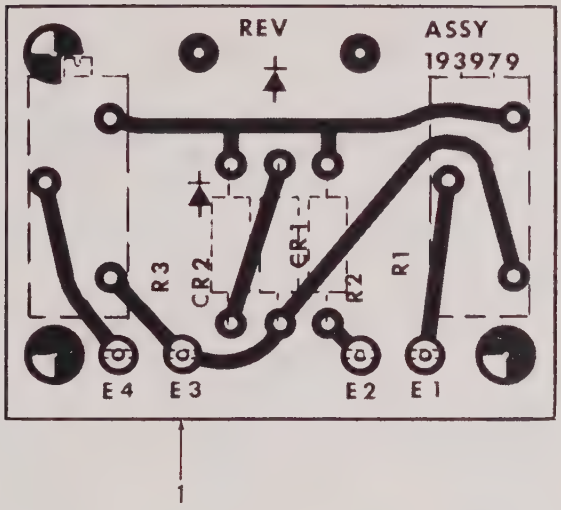


Figure 10-9. (2 Of 3)



NOTES:
1. ALL RESISTORS ARE 1/2 W OR LESS } UNLESS OTHERWISE SPECIFIED
2. ALL RESISTANCE IN OHMS
3. ALL VOLTAGE READINGS TAKEN IN REFERENCE TO GROUND.

Figure 10-9. (3 Of 3)



REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		193978	Board, Printed Wiring	
	R1,3	854387	Resistor, Variable, 10 K, ±10%, .75 W	(2)
	R2	822308	Resistor, 1K, ±5%, 1/2 W	
	CR1,2	813921	Diode, 1N752	(2)

Figure 10-10. 193979 Setpoint Board

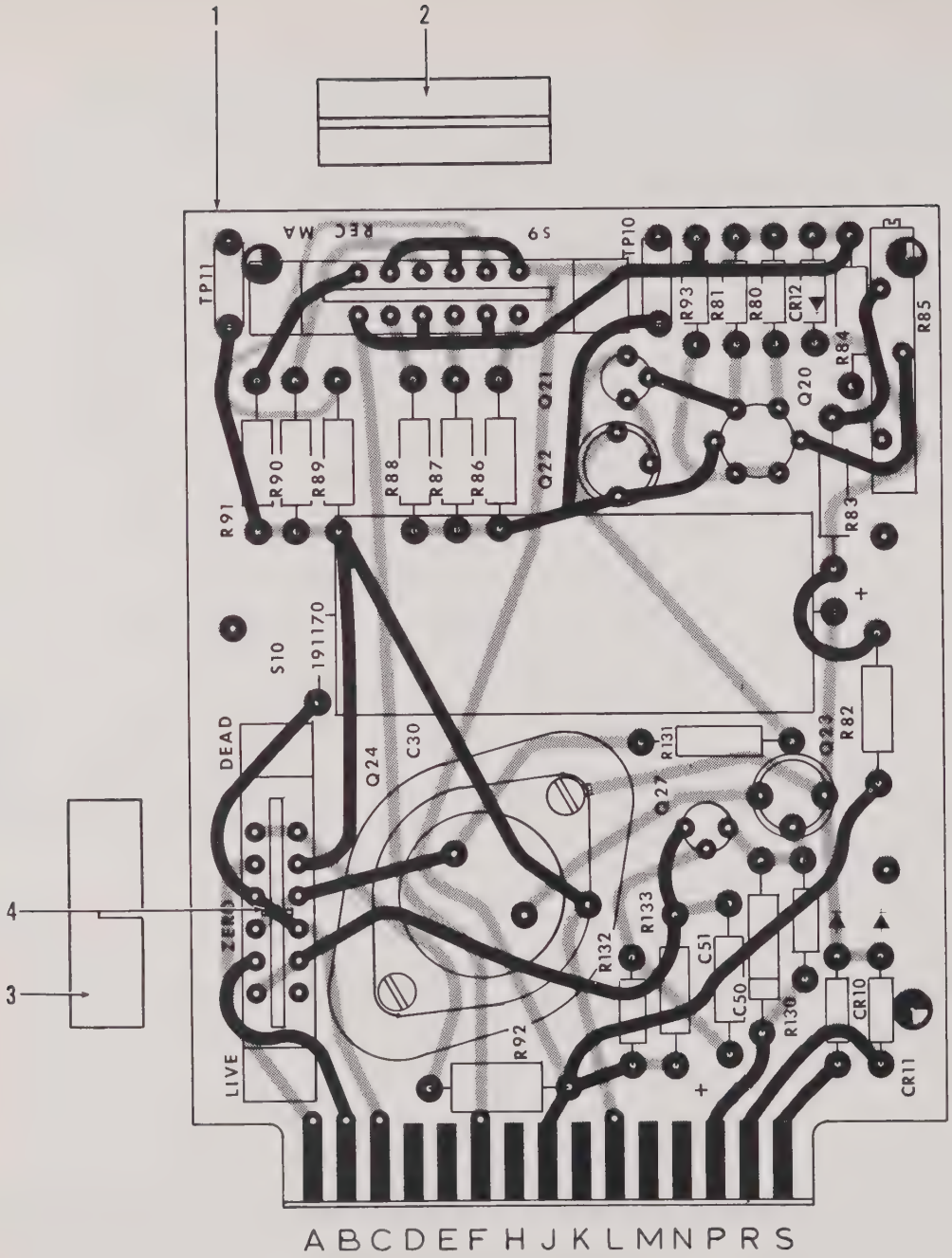


Figure 10-11. 191170 Current Output Board

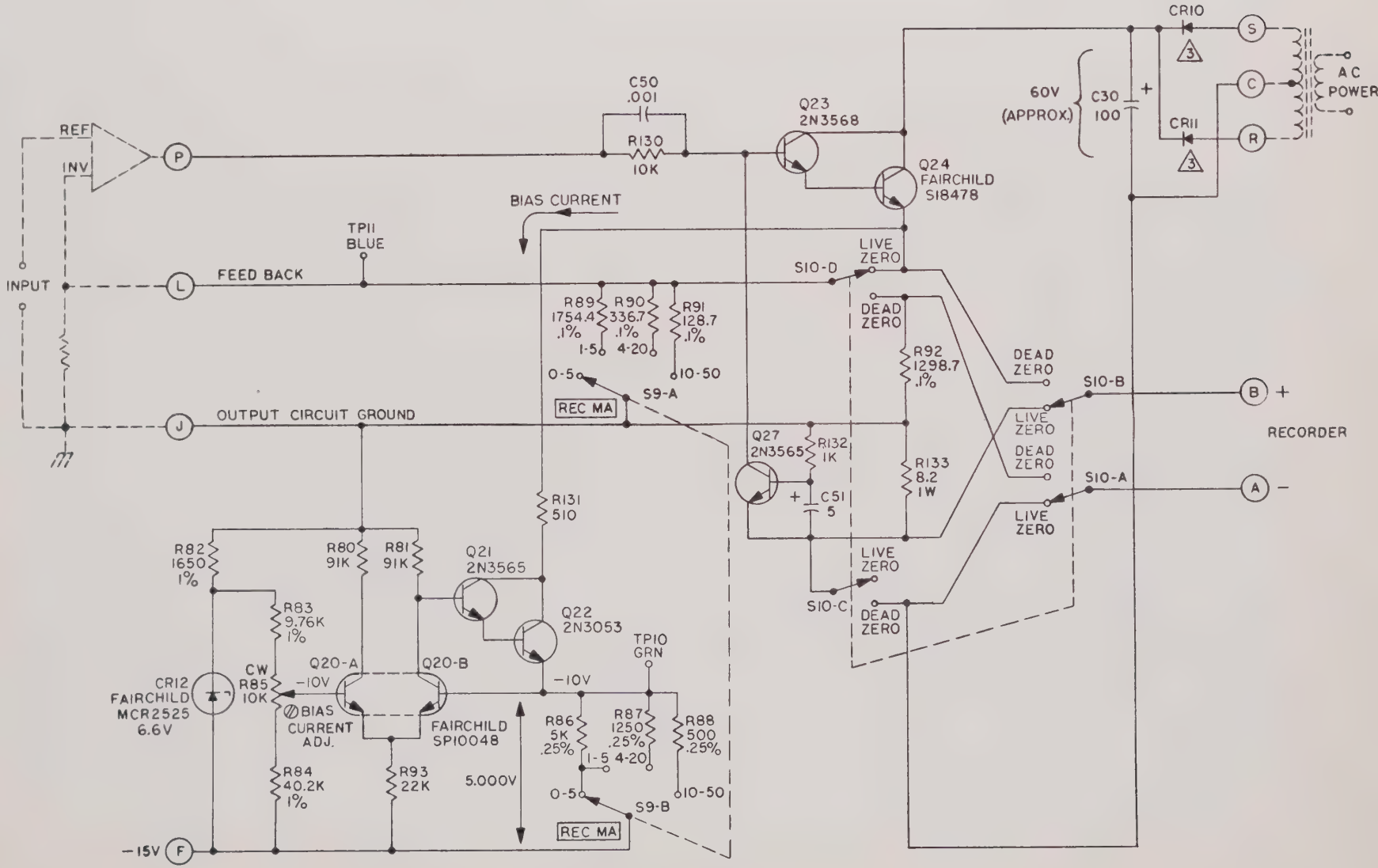
REF CIR NO.	REF	BECKMAN PART NO.	DESCRIPTION
1		191179	Board, Printed Circuit
2		190568	Selector Plug Assy
3		193213	Board, Printed Wiring
4		845048	Key
	R80, 81	822337	Resistor, 91K, ±5%, 1/4 W (2)
	R82	856028	Resistor, 1650 Ohms ±1%, 1/4 W
	R83	856027	Resistor, 9.76K, ±1%, 1/4 W
	R84	843264	Resistor, 40.2K, ±1%, 1/4 W
	R85	839172	Resistor, Variable, 10K, ±20%, 3/4 W
	R86	856043	Resistor, 5000 Ohms ±0.25%, 2/3 W
	R87	856041	Resistor, 1250 Ohms ±0.25%, 2/3 W
	R88	856040	Resistor, 500 Ohms ±0.25%, 2/3 W
	R89	856044	Resistor, 1754.4 Ohms ±0.1%, 2/3 W
	R90	856039	Resistor, 336.7 Ohms ±0.1%, 2/3 W
	R91	856038	Resistor, 128.7 Ohms ±0.1%, 2/3 W
	R92	856042	Resistor, 1298.7 Ohms ±0.1%, 2/3 W
	R93	822334	Resistor, 22K, ±5%, 1/4 W
	R130	822324	Resistor, 10K, ±5%, 1/4 W
	R131	6543	Resistor, 510 Ohms ±5%, 1/2 W
	R132	822308	Resistor, 1K, ±5%, 1/4 W
	R133	856308	Resistor, 8.2 Ohms ±5%, 1 W
	C30	816768	Capacitor, 100 uf, 150 Volts
	C50	805031	Capacitor, .001 uf, 100 Volts
	C51	856301	Capacitor, 5 uf, 6 Volts
	Q20	851855	Transistor, SP10048
	Q21, 27	838784	Transistor, 2N3565 (2)
	Q22	841578	Transistor, 2N3053
			Attaching Part:
		813549	Insulator, Transistor
	Q23	842018	Transistor, 2N3568
			Attaching Part:
		813549	Insulator, Transistor
	Q24	856025	Transistor, S18478
			Attaching Parts:
		810362	Heatsink
		804391	Screw, Pan Head 6-32 x 3/8 (2)
		42951	Insulator (2)
		808249	Washer, Ext Tooth No. 6 (2)
		808595	Nut, Hex 6-32 (2)
	TP10	829161	Jack, Test, Green
	TP11	829939	Jack, Test, Blue
	S9,10	844514	Connector (2)
	CR10, 11	817927	Diode (2)
	CR12	841042	Diode, MCR2525

191170 Current Output Board

Figure 10-11. (2 of 3)

Figure 10-11. (3 Of 3)

1. ALL RESISTORS ARE 3/4W OR LESS AND VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
3. DIODES ARE B.I.I. 817927 (400V 1 AMP) UNLESS OTHERWISE SPECIFIED.
4. ALL VOLTAGE READINGS TAKEN IN REFERENCE TO OUTPUT CIRCUIT GROUND.



CURRENT OUTPUT BOARD
ASSY NO. 191170

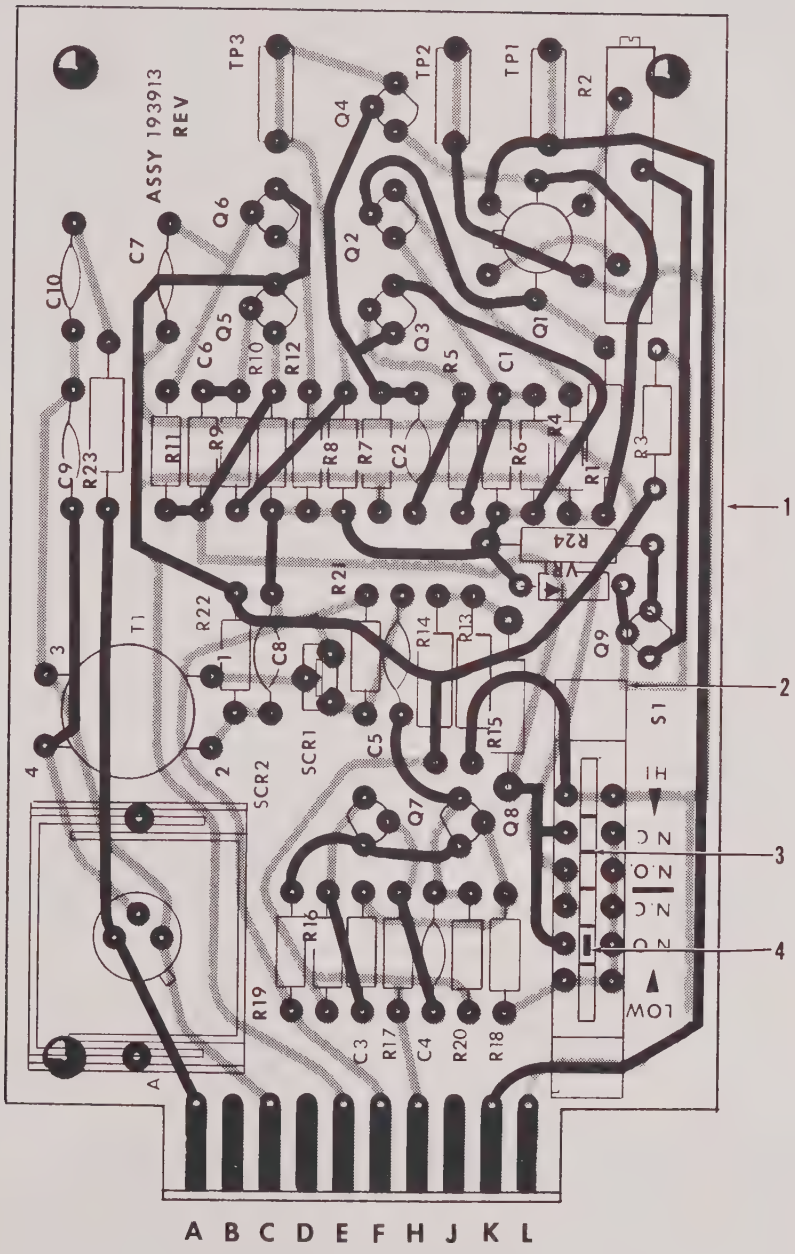


Figure 10-12. 193913 Universal Alarm Board

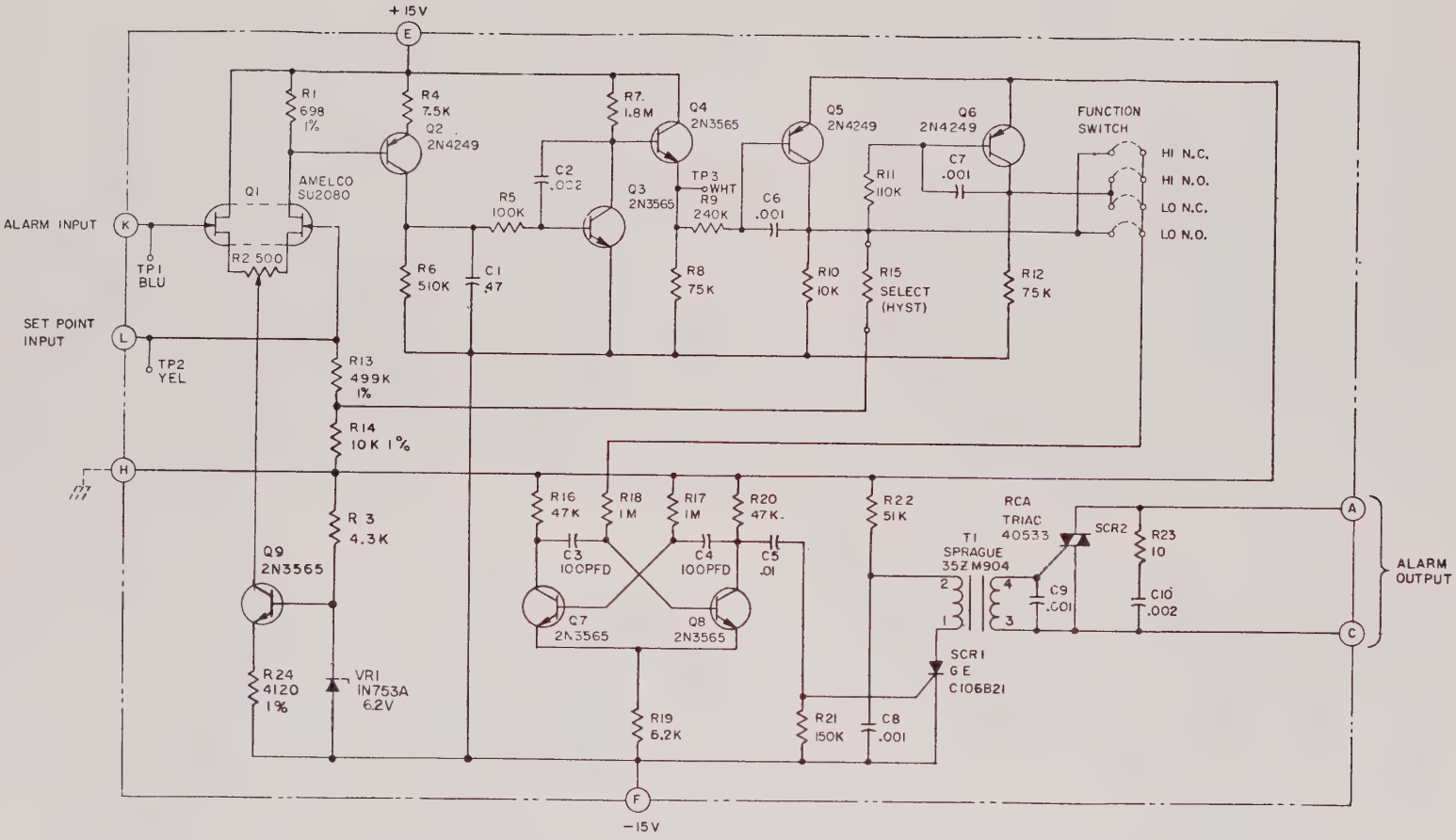
REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		193912	Board, Printed Wiring	
2	S1	844514	Connector, 6 Pin	
3		845048	Key	(5)
4		190382	Pin	
	R1	826047	Resistor, 698 Ohms, ±1%, 1/8W	
	R2	838749	Resistor, Variable, 500 Ohms, ±20%, .75W	
	R3	822329	Resistor, 4.3K, ±5%, 1/4W	
	R4	822300	Resistor, 7.5K, ±5%, 1/4W	
	R5	823904	Resistor, 100K, ±5%, 1/4W	
	R6	819681	Resistor, 510K, ±5%, 1/4W	
	R7	819689	Resistor, 1.8M, ±5%, 1/4W	
	R8,12	819673	Resistor, 75K, ±5%, 1/4W	(2)
	R9	825347	Resistor, 240K, ±5%, 1/4W	
	R10, 14	822789	Resistor, 10K, ±1%, 1/8W	(2)
	R11	819674	Resistor, 110K, ±5%, 1/4 W	
	R13	825191	Resistor, 499K, ±1%, 1/8W	
	R15	-----	Resistor, Selected, ±1% 1/4W	
	R16, 20	823902	Resistor, 47K, ±5%, 1/4W	(2)
	R17, 18	823916	Resistor, 1M, ±5%, 1/4W	(2)
	R19	822330	Resistor, 6.2 K, ±5%, 1/4W	
	R21	823906	Resistor, 150K, ±5%, 1/4W	
	R22	822305	Resistor, 51K, ±5%, 1/4 W	
	R23	22946	Resistor, 10 Ohms, ±5%, 1/2W	
	R24	866214	Resistor, 4120 Ohms, ±1%, 1/8W	
	C1	866658	Capacitor, .47 MFD, 50V	
	C2,10	804709	Capacitor, .002 MFD, 500V	(2)
	C3,4	804684	Capacitor, 100 pFD, 1000V	(2)
	C5	804718	Capacitor, .01 MFD, 500V	
	C6,7, 8,9	804706	Capacitor, .001 MFD, 500V	(4)
	Q1	856534	Transistor	
	Q2,5, 6	846165	Transistor, 2N4249	(3)
	Q3,4, 7,8,9	838784	Transistor, 2N3565	(5)
	VR1	822858	Diode, 1N753A	
	SCR1	856225	Rectifier	
	SCR2	856935	Triac	
	T1	856934	Transformer	
	TP1	829939	Jack, Test	
	TP2	810282	Jack, Test	
	TP3	810281	Jack, Test	

193913 Universal Alarm Board

Figure 10-12. (2 of 3)

Figure 10-12. (3 Of 3)

ALARM BOARD
193913



4 ALL VOLTAGE READINGS TAKEN IN REFERENCE TO GROUND.
3 ALL CAPACITANCE IN MICROFARADS
2 ALL RESISTOR ARE 1/2W OR LESS } UNLESS OTHERWISE SPECIFIED
1 ALL RESISTANCE IN OHMS

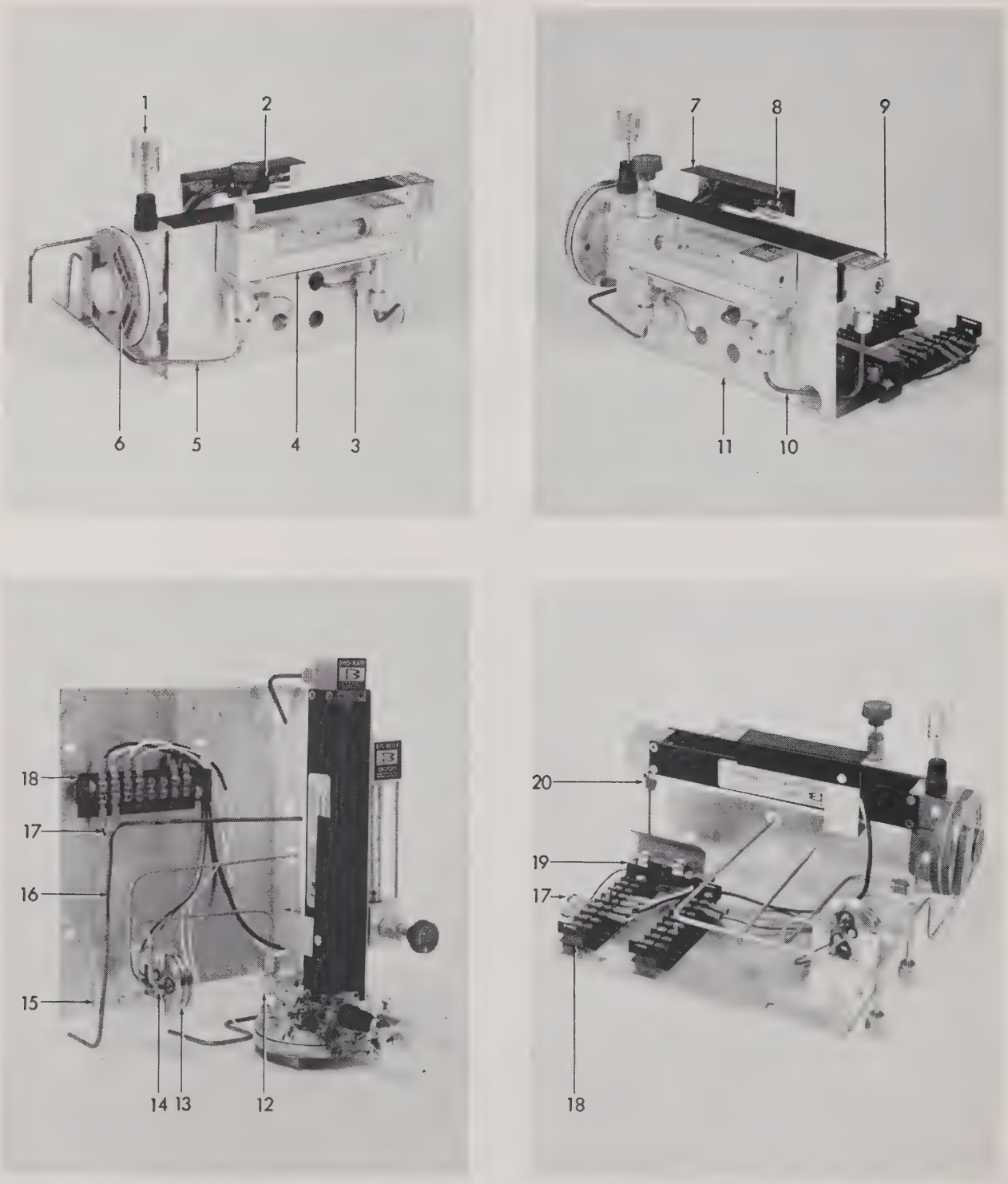


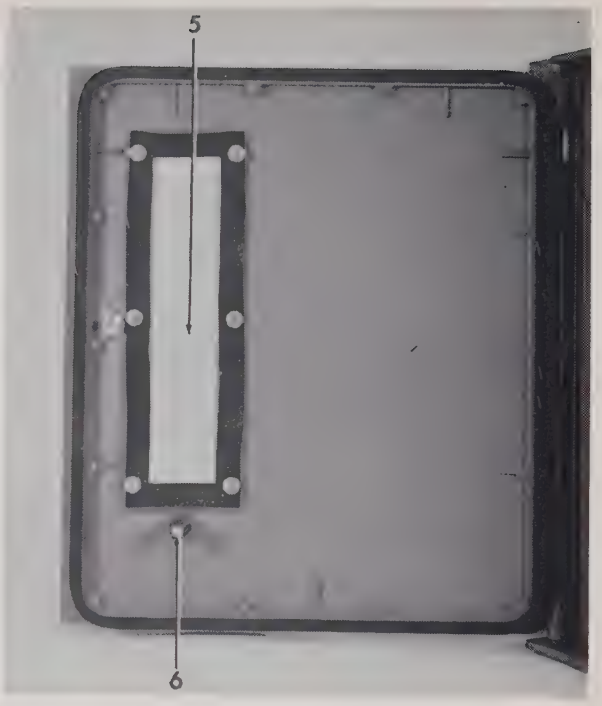
Figure 10-13. 194776, 194777, 194778 and 194784 Chassis Assemblies

REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	SST 194776	SST 194777	194778	194784
1		193175	Collar, Flowmeter	1	1	1	1
			Attaching Part:				
		803484	Screw, Set, 4-40 x 1/4	2	2	2	2
2		194779	Holder, Lamp	1	1	1	1
3		810156	Fitting, Tee	2	2	0	0
		16487	Fitting, Tee	0	0	2	2
4		866025	Flowmeter, SST	1	1	0	0
		866024	Flowmeter	0	0	1	1
5		630184	Tubing, Sample - In	1	1	0	0
		630185	Tubing, Sample - In	0	0	1	1
6	R1	193123	Heater	1	1	1	1
7		193159	Shield, Lamp	1	1	1	1
			Attaching Parts:				
		809917	Screw, Pan Head, 6-32 x 5/16	1	1	1	1
		808266	Washer, Split, No. 6	1	1	1	1
		810690	Washer, Flat, No. 6	1	1	1	1
		808595	Nut, Hex, 6-32	1	1	1	1
8	DS1	860001	Lamp, Incandescent	1	1	1	1
9		194735	Flowmeter Assy, SST	1	1	0	0
		194736	Flowmeter Assy	0	0	1	1
			Attaching Parts:				
		804391	Screw, Pan Head, 6-32 x 3/8	4	4	4	4
		808266	Washer, Split, No. 6	4	4	4	4
		810690	Washer, Flat, No. 6	4	4	4	4
10		193183	Tubing	1	1	0	0
		193184	Tubing	0	0	1	1
11		194723	Chassis	1	1	1	1
12		866026	Fitting, Elbow	1	1	0	0
		812890	Fitting, Elbow	0	0	1	1

REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	SST 194776	SST 194777	194778	194784
13		193189	Manifold Assy	1	1	1	1
			Attaching Parts:				
		809917	Screw, Pan Head, 6-32 x 5/16	2	2	2	2
		808266	Washer, Split, No. 6	2	2	2	2
14		193195	Pin, Contact	2	2	2	2
			Attaching Parts:				
		193196	Insulator, Contact	4	4	4	4
		808594	Nut, Hex, 4-40	2	2	2	2
15		193158	Bracket, Manifold	1	1	1	1
			Attaching Parts:				
		808268	Washer, Split, No. 8	2	2	2	2
		812622	Nut, Hex, 8-32	2	2	2	2
16		630181	Tubing, Sample - Out	1	1	0	0
		630182	Tubing, Sample - Out	0	0	1	1
17	CR1	194766	Diode Assy	1	1	1	1
18	TB1,2	1867	Block, Terminal	1	2	2	1
			Attaching Parts:				
		62842	Marker, Strip	1	2	2	1
		171192	Bracket, Support	2	4	4	2
		99677	Lug, Terminal	1	2	2	1
		804404	Screw, Pan Head, 6-32 x 5/8	2	4	4	2
		808266	Washer, Split, No. 6	2	4	4	2
		810690	Washer, Flat, No. 6	2	4	4	2
19		805947	Holder, Fuse	0	1	1	0
			Attaching Parts:				
		194765	Shield, Fuse	0	1	1	0
		809917	Screw, Pan Head, 6-32 x 5/16	0	1	1	0
	F1	8395	Fuse, 1 Amp	0	1	1	0
20		829587	Fitting, Combination	1	1	0	0
		817743	Fitting, Combination	0	0	1	1

194776, 194777, 194778, 194784 Chassis Assembly

Figure 10-13. (2 of 2)



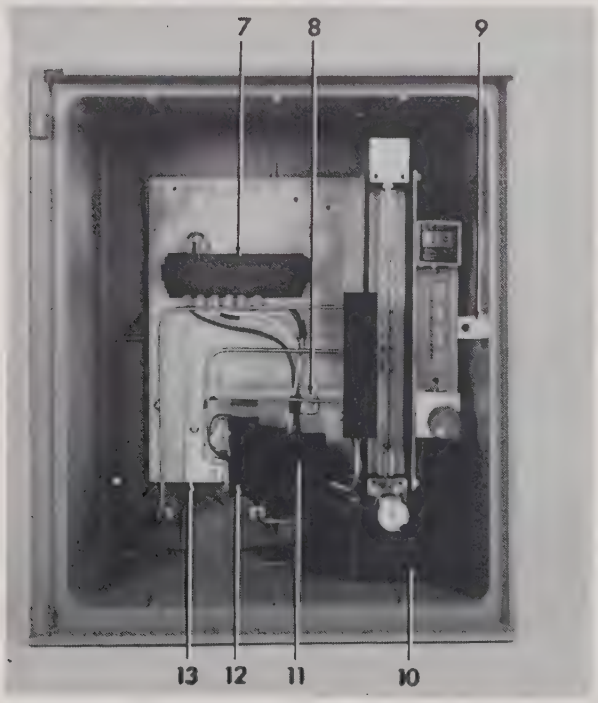
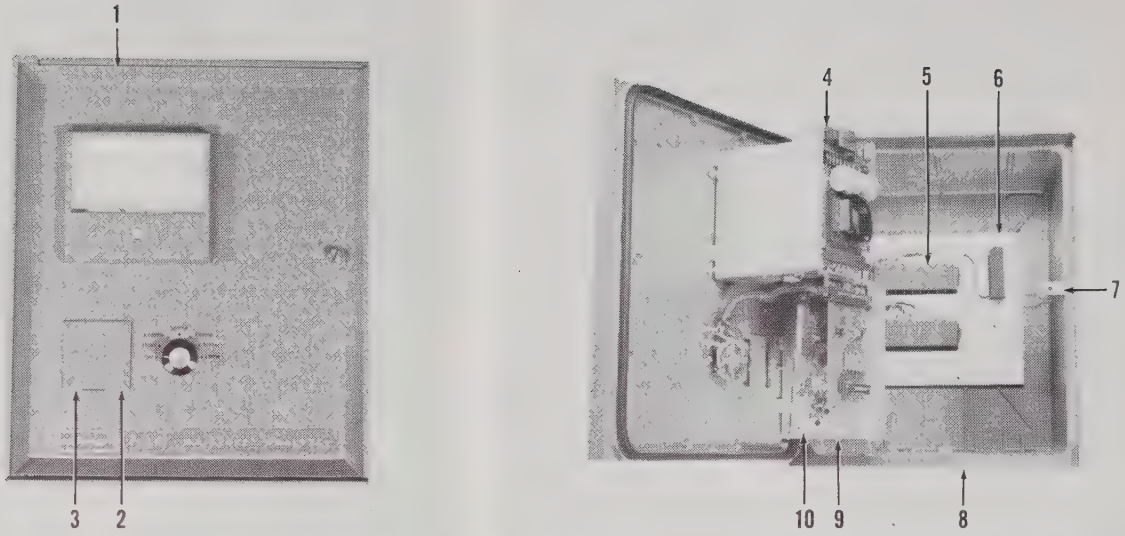


Figure 10-14. 194780 Remote Detector Assembly

REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	SST 194780	194785
1		193167	Door, Machined	1	1
			Attaching Parts:		
		101471	Washer	2	2
		827559	Washer, Nylon	2	2
2		190889	Screw, Door Lock	1	1
			Attaching Parts:		
		17575	Ring, Retaining	1	1
		802651	Washer, Nylon	1	1
3		816808	Knob	1	1
4		194746	Nameplate	1	1
5		193169	Window	1	1
			Attaching Parts:		
		194764	Gasket, Window	1	1
		810690	Washer, Flat, No. 6	6	6
		808595	Nut, Hex, 6-32	6	6
6		193178	Shaft Assy, Flowmeter	1	1
			Attaching Parts:		
		5694	Bushing, Threaded	1	1
		12676	Seal	1	1
		801466	Retaining Ring	1	1
7		190371	Shield, Terminal	1	1
8		499	Clamp, Cable	1	1
			Attaching Parts:		
		809917	Screw, Pan Head, 6-32 x 5/16	1	1
		79347	Washer, Cable Clamp	1	1
9		190357	Bracket, Door Lock	1	1
			Attaching Parts		
		804391	Screw, Pan Head 6-32 x 3/8	2	2
		808266	Washer, Split, No. 6	2	2
10		194734	Insulator	1	1
11		193190	Cell Assy	1	1
12		194725	Holder, Cell	1	1
13		194776	Chassis Assy, Detector	1	0
		194784	Chassis Assy, Detector	0	1
			Attaching Parts:		
		809916	Screw, Pan Head, 6-32 x 1/4	3	3
		808266	Washer, Split, No. 6	3	3
		810690	Washer, Flat, No. 6	3	3
14		866487	Screw, Pan Head, 5/16-18-1/4	2	2
15		811791	Fitting, Bulkhead	2	0
		29700	Fitting, Bulkhead	0	2
			Attaching Part:		
		802193	Washer, Int Tooth	2	2
16		856755	Filter	1	1
17		193180	Case, Machined	1	1

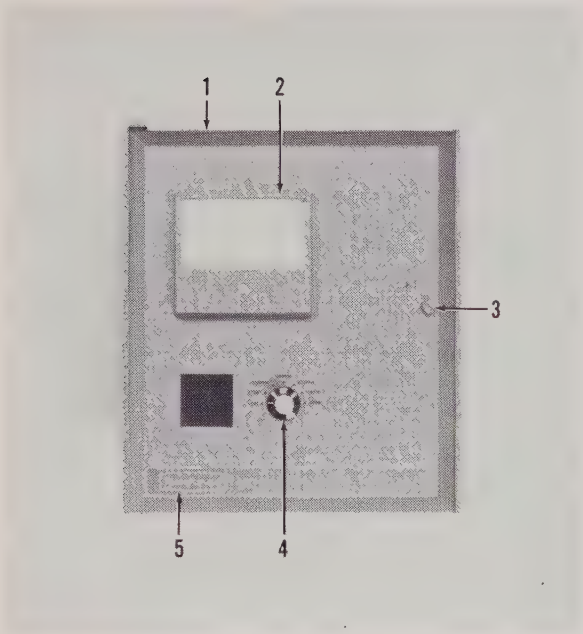
194780, 194785 Detector Assembly, Remote

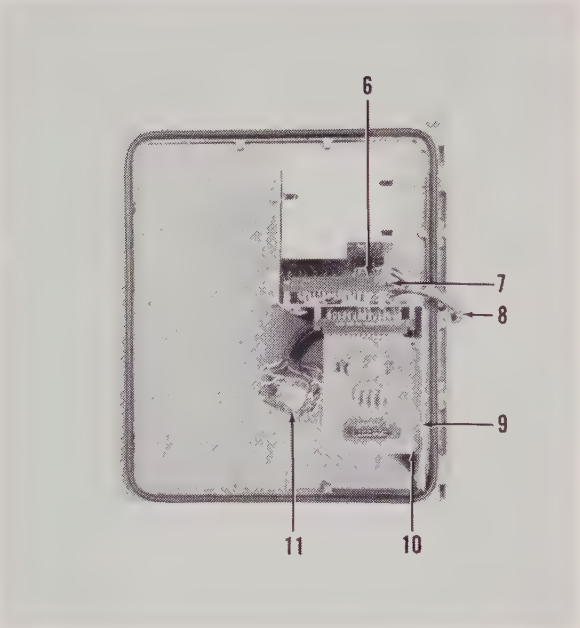
Figure 10-14. (2 of 2)



REF NO.	CIR REF	BECKMAN PART NO.		DESCRIPTION	QTY
1		194787		Door Assy	
				Attaching Parts:	
		101471	*	Washer	(2)
		827559	*	Washer, Nylon	(2)
2		194760	*	Alarm Set Point Assy	As Ord
3		194729		Plate, Alarm	A.R.(1)
				Attaching Parts:	
		194730	*	Gasket	A.R.(1)
		194728		Clamp, Plate	A.R.(1)
		808591	S	Nut, Full, 4-40	A.R.(2)
4		191170		Board Assy, Current Output	As Ord
				Attaching Parts:	
		79224	S	Spacer	(3)
		809919	S	Screw, Pan Head, 6-32 x 1/2	(3)
		810690	S	Washer, Flat, No. 6	(3)
5		190371		Shield, Terminal	(2)
6		194786		Plate Assy, Mtg.	
				Attaching Parts:	
		809916	S	Screw, Pan Head, 6-32 x 1/4	(3)
		808266	S	Washer, Split, No. 6	(3)
		810690	S	Washer, Flat, No. 6	(3)
7		190357		Bracket, Door Lock	
				Attaching Parts:	
		804391	S	Screw, Pan Head, 6-32 x 3/8	(2)
		808266	S	Washer, Split, No. 6	(2)
8		193180		Case, Machined	
				Attaching Part:	
		866487	*	Screw, Pan Head, 5/16-18 x 1/4	(2)
9		193171		Bracket, Alarm Bd.	
				Attaching Parts:	
		809916	S	Screw, Pan Head, 6-32 x 1/4	
		808266	S	Washer, Split, No. 6	
10		193913		Board, Universal Alarm	As Ord
				Attaching Parts:	
		809916	S	Screw, Pan Head, 6-32 x 1/4	
		810690	S	Washer, Flat, No. 6	
		808595	S	Nut, Hex, 6-32	

Figure 10-15. 194790 Remote Controller Assembly

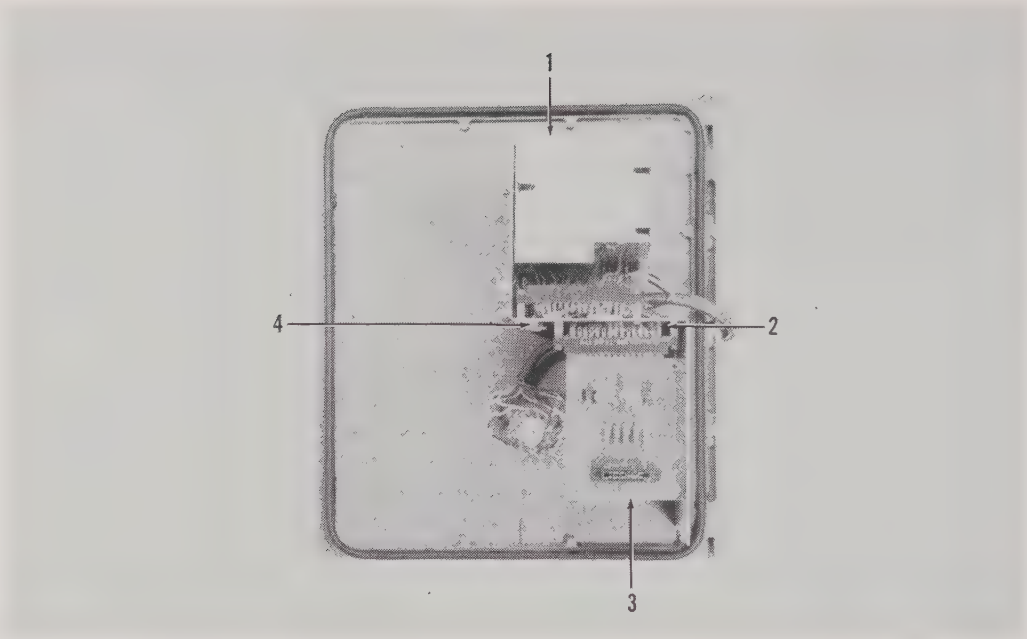




REF NO.	CIR REF	BECKMAN PART NO.		DESCRIPTION	QTY
1		193166		Door, Machined	
2		194781		Meter Assy	
				Attaching Part:	
		77820		Gasket, Meter	
3		190889		Screw, Door Lock	
				Attaching Parts:	
		802651		Washer, Nylon	
		17575		Ring, Retaining	
4		816816	S	Knob, Round	
5		194746		Nameplate	
6	J1,2, 4	823481	S*	Connector, 15 Pin	(3)
				Attaching Parts:	
		809233		Spacer, Threaded	(6)
		809890	S	Screw, Pan Head, 4-40 x 1/4	(6)
		808264	S	Washer, Split, No. 4	(6)
		809892	S	Screw, Pan Head, 4-40 x 3/8	(6)

REF NO.	CIR REF	BECKMAN PART NO.		DESCRIPTION	QTY
7		596	S	Clamp, Cable	(2)
				Attaching Parts:	
		804391	S	Screw, Pan Head, 6-32 x 3/8	(2)
		79347	S	Washer, Cable Clamp	(2)
8		194756		Harness	
9		193154		Chassis, Door	
				Attaching Parts:	
		810690	S	Washer, Flat, No. 6	(4)
		808266	S	Washer, Split, No. 6	(4)
		808595	S	Nut, Hex, 6-32	(4)
10		193170		Bracket, Support	
				Attaching Parts:	
		804391	S	Screw, Pan Head, 6-32 x 3/8	
		810690	S	Washer, Flat, No. 6	
		808266	S	Washer, Split, No. 6	
		808595	S	Nut, Hex, 6-32	
11	S1	193155		Switch, Attenuator	

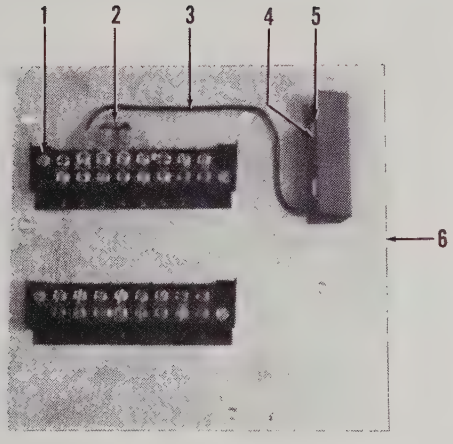
Figure 10-16. 194787 Remote Door Assembly



REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		190395	Power Supply Assy	
			Attaching Parts:	
		809943 S	Screw, Pan Head, 8-32 x 3/8	(2)
		802137 S	Washer, Flat, No. 8	(2)
		808268 S	Washer, Split, No. 8	(2)
2	J3	815702 S*	Connector, 10 Pin	
			Attaching Parts:	
		809233	Spacer, Threaded	(2)
		809890 S	Screw, Pan Head, 4-40 x 1/4	(2)
		808264 S	Washer, Split, No. 4	(2)
		809892 S	Screw, Pan Head, 4-40 x 3/8	(2)

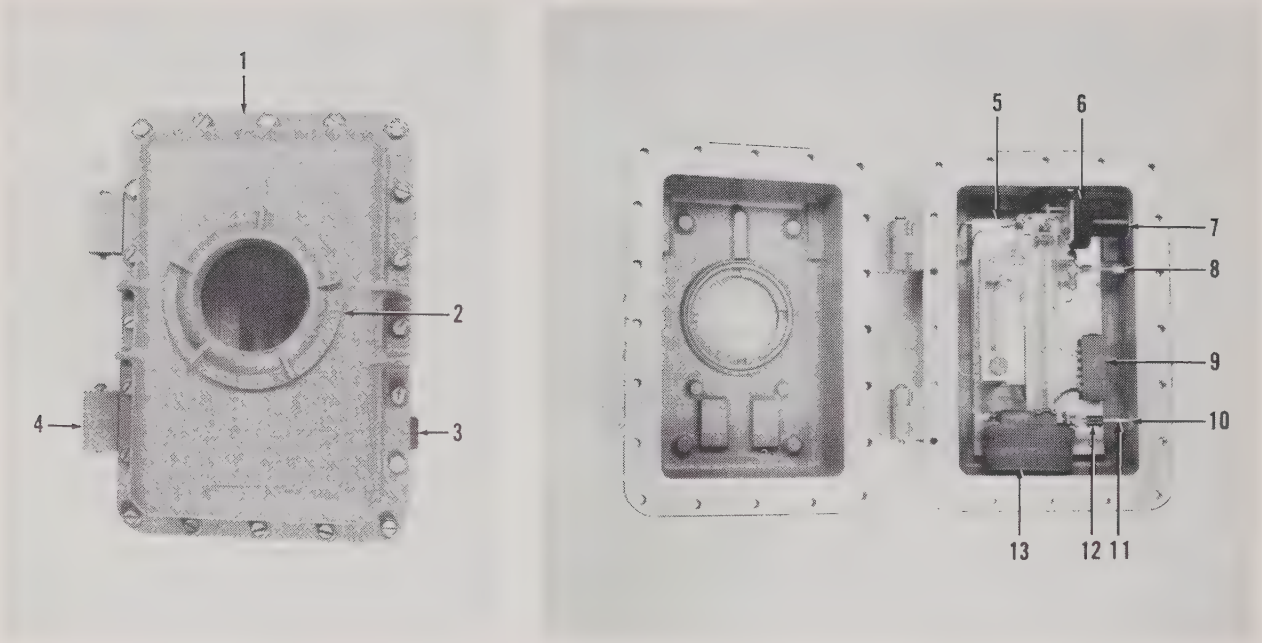
REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
3		193128	Board Assy, Amplifier	
			Attaching Parts:	
		804391 S	Screw, Pan Head, 6-32 x 3/8	
		808266 S	Washer, Split, No. 6	
		810690 S	Washer, Flat, No. 6	
		808595 S	Nut, Hex, 6-32	
4		816673 S*	Socket	
			Attaching Parts:	
		809889 S	Screw, Pan Head, 4-40 x 3/16	(2)
		808264 S	Washer, Split, No. 4	(2)
		808594 S	Nut, Hex, 4-40	(2)
		6819 *	Header, 7 Pin	
		14143	Cap	

Figure 10-16. (2 Of 2)



REF NO.	CIR REF	BECKMAN PART NO.		DESCRIPTION	QTY
1		1867	S	Block, Terminal	(2)
				Attaching Parts:	
		62842		Marker Strip	(2)
		99677		Lug, Terminal	(2)
		171192		Bracket, Shield	(4)
		804404	S	Screw, Pan Head, 6-32 x 5/8	(4)
		808266	S	Washer, Split, No. 6	(4)
		810690	S	Washer, Flat, No. 6	(4)
2	CR1	194766		Diode Assy	
3		649042	S	Jumper, Blk	
4	F1	8395	S	Fuse, 1 Amp	
5		805947		Holder, Fuse	
				Attaching Parts:	
		194765		Shield, Fuse	
		804391	S	Screw, Pan Head, 6-32 x 3/8	
6		193177		Plate, Mtg.	

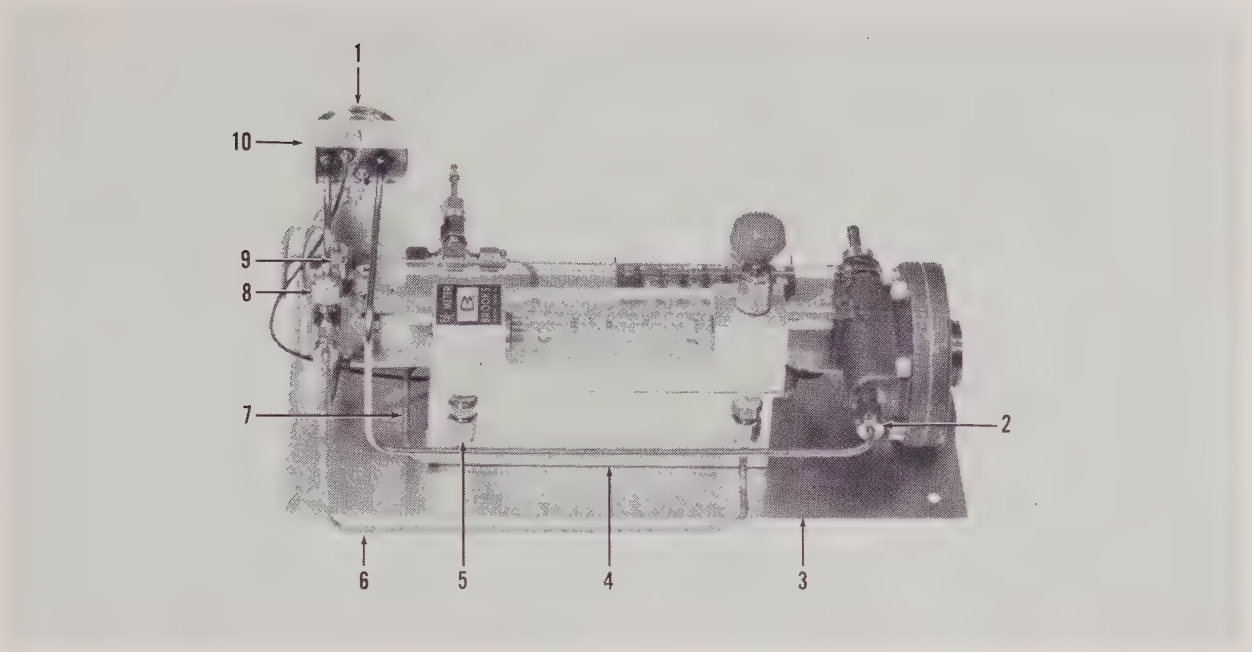
Figure 10-17. 194786 Mounting Plate Assembly



REF CIR NO.	REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		194721	Box, Machined	
			Attaching Parts:	
		848567	Screw, Hex Head, 3/8-16 x 1 3/4	(20)
		808275	Washer, Split, 3/8	(20)
2		194791	Cover, Painted	
3		816808	Knob	
4		194722	Hinge, Painted	(2)
			Attaching Part:	
		838622	Screw, Flat Head, 1/4-20 x 2	(4)
		838997	Screw, Flat Head, 1/4-20 x 1	(4)

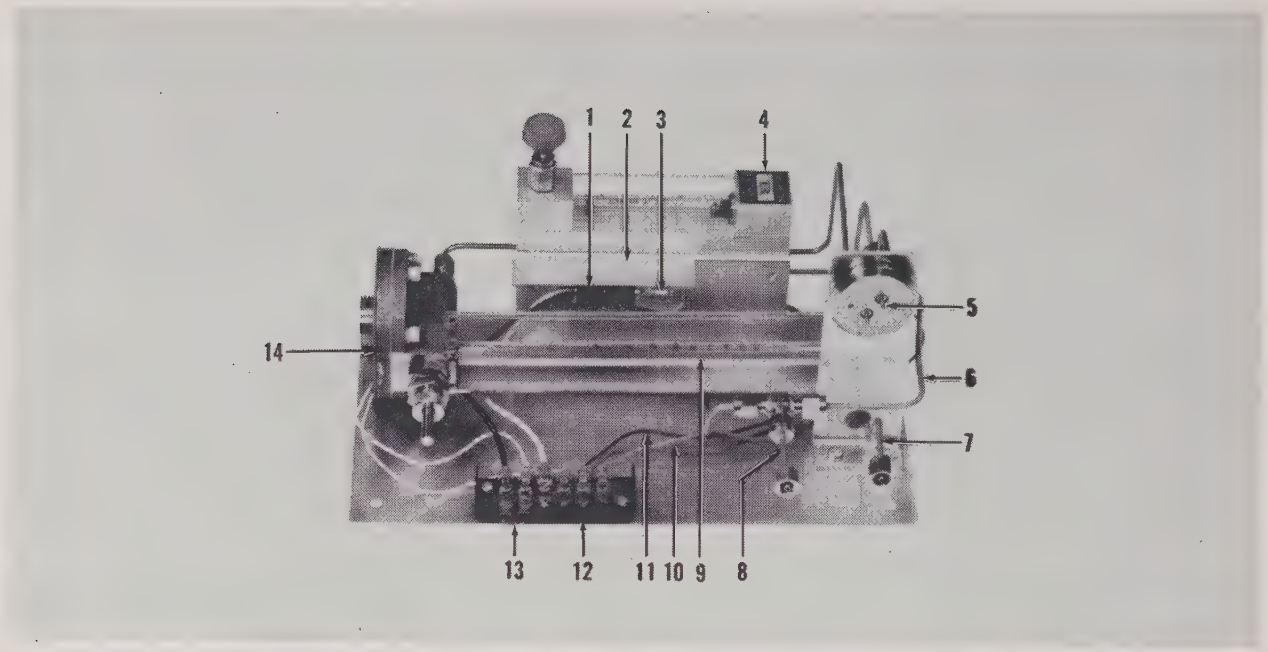
REF CIR NO.	REF	BECKMAN PART NO.	DESCRIPTION	QTY
5		194783	Chassis Assy	
			Attaching Parts:	
		809942	Screw, Pan Head, 8-32 x 5/16	(4)
		808268	Washer, Split, No. 8	(4)
6		194725	Holder, Cell	
7		193190	Cell Assy	
8		811791	Fitting, Bulkhead	(2)
			Attaching Parts:	
		802193	Washer, Int Tooth	(2)
		856755	Filter	(2)
9		190370	Shield, Terminal	
10		194719	Bushing, Shaft	
11		194720	Shaft	
12		866036	Coupling, Flexible	
13		194734	Insulator	

Figure 10-18. 194788 Explosion-Proof Detector Assembly



REF CIR NO. REF	BECKMAN PART NO.	DESCRIPTION	QTY
1	194724	Manifold Assy	
		Attaching Parts:	
	809916	Screw, Pan Head, 6-32 x 1/4	(2)
	808266	Washer, Split, No. 6	(2)
2	812345	Fitting	
3	194716	Plate, Mounting	
4	194717	Bracket, Flowmeter	
		Attaching Parts:	
	809943	Screw, Pan Head, 8-32 x 3/8	(2)
	808268	Washer, Split, No. 8	(2)
	802137	Washer, Flat, No. 8	(2)
5	8436	Fitting	(2)
6	194714	Tube, Inlet	
7	194713	Tube, Outlet	
8	29753	Fitting, Tee	(2)
9	829587	Fitting	
10	193174	Bracket, Manifold	
		Attaching Parts:	
	809943	Screw, Pan Head, 8-32 x 3/8	(2)
	808268	Washer, Split, No. 8	(2)

Figure 10-19. 194783 Explosion-Proof Chassis Assembly

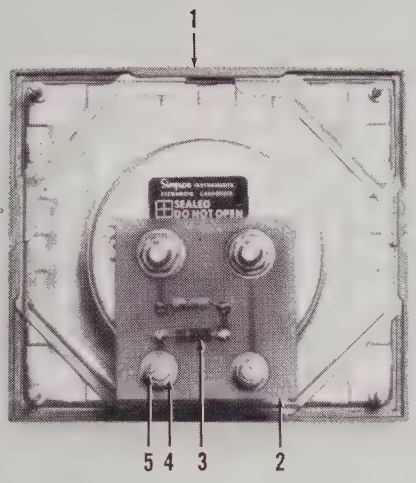


REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		194779	Holder, Lamp	
2		193159	Shield, Lamp	
			Attaching Parts:	
		809917	Screw, Pan Head, 6-32 x 5/16	
		808266	Washer, Split, No. 6	
		810690	Washer, Flat, No. 6	
3	DS1	860001	Lamp, Incandescent	
4		866025	Flowmeter	
5		193195	Pin, Contact	(2)
			Attaching Parts:	
		193196	Insulator, Contact	(4)
		808594	Nut, Hex, 4-40	(2)
6		194715	Tube, Sample Outlet	
7		194712	Tube, Inlet	
8		194711	Tube, Outlet	
9		194735	Flowmeter Assy	

REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
			Attaching Parts:	
		809916	Screw, Pan Head, 6-32 x 1/4	(4)
		808266	Washer, Split, No. 6	(4)
10		649041	Jumper, Gy	
11		649040	Jumper, Grn	
12	TB3	9949	Block, Terminal	
			Attaching Parts:	
		816982	Marker Strip	
		171192	Bracket, Shield Support	(2)
		804404	Screw, Pan Head, 6-32 x 5/8	(2)
		810690	Washer, Flat, No. 6	(2)
		808266	Washer, Split, No. 6	(2)
		99677	Lug, Terminal	
13	CR1	194766	Diode Assy	
14	R1	193123	Heater	

194783 Chassis Assy, Explosion Proof

Figure 10-19. (2 of 2)



REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		194747	Meter	
2		190915	Board Assy	
3	R19	------	Resistor, Selected, ±5%, 1/2 W	
4		809916	Screw, Pan Head, 6-32 x 1/4	(2)
5		808266	Washer, Split, No. 6	(2)

Figure 10-20. 194753 Meter Assembly (Portable Analyzers)

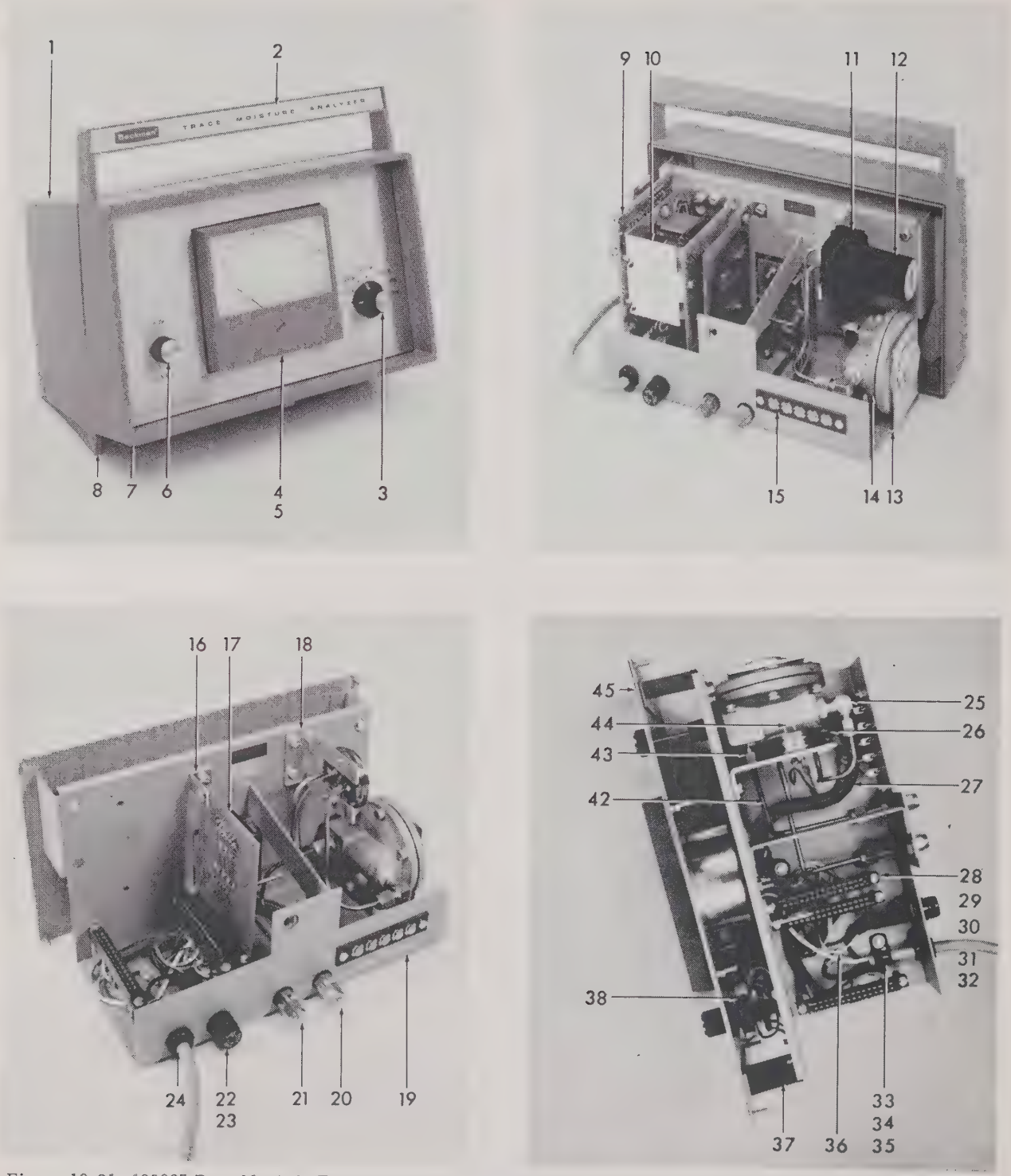
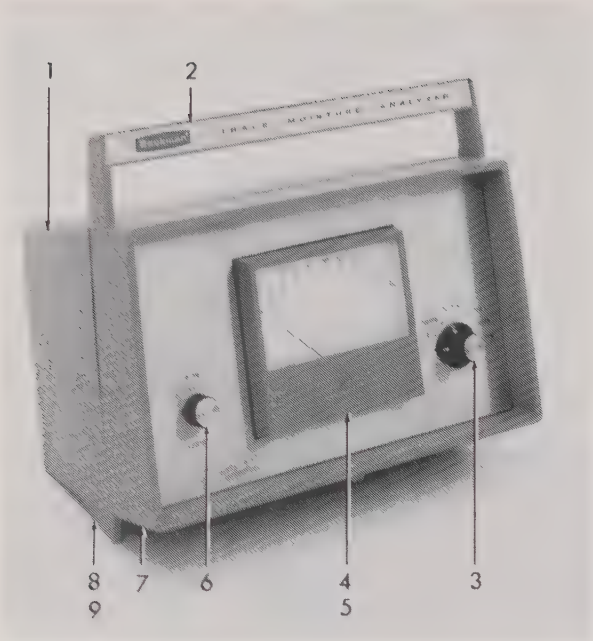
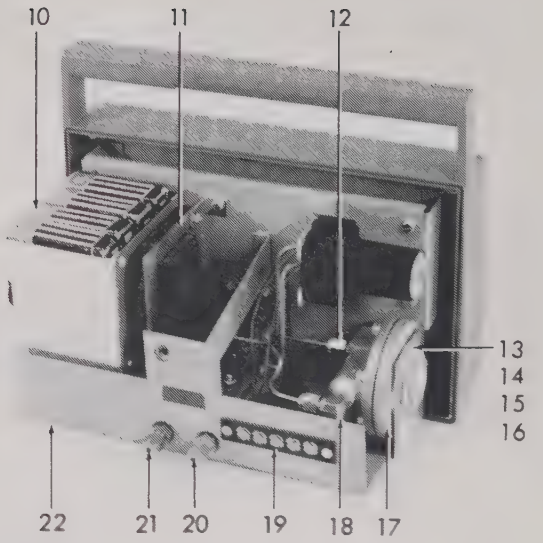


Figure 10-21. 193005 Portable A.C. Trace Moisture Analyzer

REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		193129	Cover, Machined	
			Attaching Parts:	
		866017	Screw, Fastener	
		821830	Washer, Retainer	
2		193150	Panel, Marked	
3		816816	Knob, Round	
4	M1	194753	Meter Assy	
5		95845	Gasket, Meter	
6		823690	Knob, Round	
7		193179	Bezel, Painted	
			Attaching Parts:	
		808266	Washer, Split, No. 6	(4)
		808595	Nut, Hex, 6-32	(4)
8		816951	Bumper	(4)
			Attaching Part:	
		809869	Screw, Pan Head, 2-56 x 1/4	(4)
9		191170	Board Assy,	(AS ORD)
			Attaching Parts:	
		79224	Spacer	(3)
		804404	Screw, Pan Head, 6-32 x 5/8	(3)
		810690	Washer, Flat, No. 6	(3)
		808266	Washer, Split, No. 6	(3)
10		190395	Power Supply Assy	
			Attaching Parts:	
		809943	Screw, Pan Head, 8-32 x 3/8	(2)
		808268	Washer, Split, No. 8	(2)
		802137	Washer, Flat, No. 8	(2)
11		194725	Holder, Cell	
12		193190	Cell, Trace Moisture	
13		194733	Bracket, Regulator	
			Attaching Parts:	
		809975	Screw, Pan Head, 10-32 x 3/8	(2)
		802141	Washer, Flat, No. 10	(2)
		802184	Washer, Split, No. 10	(2)
14		194748	Regulator, Flow	
15	TB1	24023	Terminal Strip	
			Attaching Parts:	
		809917	Screw, Pan Head, 6-32 x 5/16	(2)
		808266	Washer, Split, No. 6	(2)
		808595	Nut, Hex, 6-32	(2)
16		193151	Bracket, Support	
			Attaching Parts:	
		809943	Screw, Pan Head, 8-32 x 3/8	
		808268	Washer, Split, No. 8	
17		193128	Board Assy, Amplifier	
			Attaching Parts:	
		809917	Screw, Pan Head, 6-32 x 5/16	
		808266	Washer, Split, No. 6	
		808595	Nut, Hex, 6-32	
18		193124	Bracket, Manifold	
			Attaching Parts:	
		809943	Screw, Pan Head, 8-32 x 3/8	(2)
		808268	Washer, Split, No. 8	(2)
19		193111	Chassis, Welded	
20		29700	Fitting, Bulkhead	
			Attaching Part:	
		802193	Washer, Int Tooth	
21		811791	Fitting, Bulkhead	
			Attaching Parts:	
		802193	Washer, Int Tooth	
		856755	Filter	
22		7268	Holder, Fuse	
23	F1	29623	Fuse, 3/4 Amp	
24		630189	Cord Assy, Power	
			Attaching Part:	
		12042	Clamp, Cable	
25		812890	Fitting, Elbow	
26		193146	Manifold Assy	
			Attaching Parts:	
		809917	Screw, Pan Head, 6-32 x 5/16	(2)
		808266	Washer, Split, No. 6	(2)
27		193138	Harness	
28	J1,2, 3	823481	Connector	(3)
29		866016	Spacer, Threaded	(6)
30		809892	Screw, Pan Head, 4-40 x 3/8	(12)
31		808264	Washer, Split, No. 4	(12)
32		811756	Washer, Flat, No. 4	(6)
33		79350	Clamp, Cable	
34		79347	Washer, Cable Clamp	
35		809916	Screw, Pan Head, 6-32 x 1/4	
36		809889	Screw, Pan Head, 4-40 x 3/16	
37		193114	Panel, Welded - Front	
			Attaching Parts:	
		812134	Screw, Flat Head, 8-32 x 1/4	(2)
		809943	Screw, Pan Head, 8-32 x 3/8	(2)
		808268	Washer, Split, No. 8	(2)
		802137	Washer, Flat, No. 8	(2)
38	S1	193155	Switch, Attenuator	
39				
40				
41				
42		630190	Tubing, Outlet	
43		866021	Fitting, Combination	
44		193195	Pin, Contact	(2)
			Attaching Parts:	
		193196	Insulator, Contact	(4)
		808594	Nut, Hex, 4-40	(2)
45		193141	Panel, Marked	

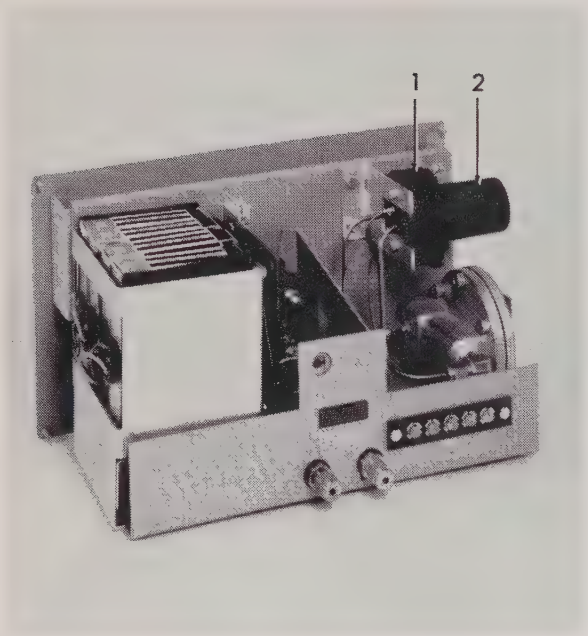
Figure 10-21. (2 of 2)

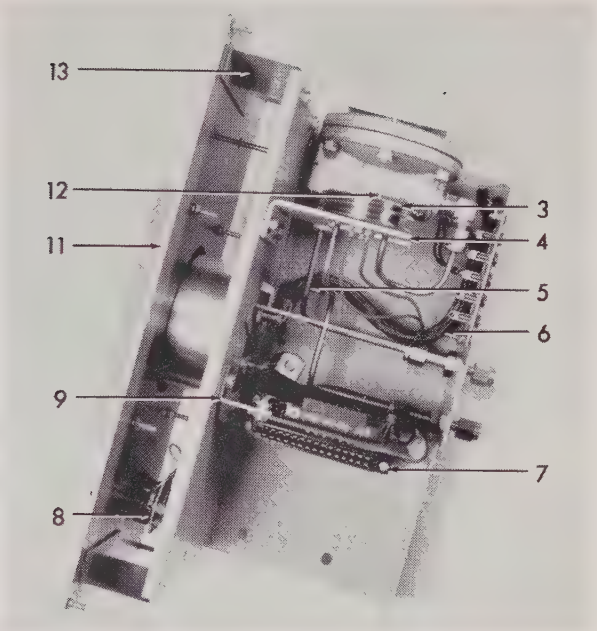




REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		193129	Cover, Machined	
			Attaching Parts:	
		866017	Screw, Fastener	(4)
		821830	Washer, Retainer	(4)
2		193150	Panel, Marked	
3		816816	Knob, Round	
4	M1	194753	Meter Assy	
5		95845	Gasket, Meter	
6		823690	Knob, Round	
7		193179	Bezel, Painted	
			Attaching Parts:	
		808266	Washer, Split, No. 6	(4)
		808595	Nut, Hex, 6-32	(4)
8		816951	Bumper	(4)
9		809869	Screw, Pan Head, 2-56 x 1/4	(4)
10		194771	Battery Pack Assy	
			Attaching Parts:	
		809942	Screw, Pan Head, 8-32 x 5/16	(2)
		808268	Washer, Split, No. 8	(2)
		802137	Washer, Flat, No. 8	(2)
11		193128	Board Assy, Amplifier	
			Attaching Parts:	
		809917	Screw, Pan Head, 6-32 x 5/16	
		808266	Washer, Split, No. 6	
		808595	Nut, Hex, 6-32	
12		866021	Fitting, Combination	
13		194733	Bracket, Regulator	
14		809975	Screw, Pan Head, 10-32 x 3/8	(2)
15		802141	Washer, Flat, No. 10	(2)
16		802184	Washer, Split, No. 10	(2)
17		194748	Regulator, Flow	
18		812890	Fitting, Elbow	
19		24023	Terminal Strip	
			Attaching Parts:	
		809917	Screw, Pan Head, 6-32 x 5/16	(2)
		808266	Washer, Split, No. 6	(2)
		808595	Nut, Hex, 6-32	(2)
20		29700	Fitting, Bulkhead	
			Attaching Part:	
		802193	Washer, Int Tooth	
21		811791	Fitting, Bulkhead	
			Attaching Parts:	
		802193	Washer, Int Tooth	
		866755	Filter	

Figure 10-22. 193300 Portable P.C. Trace Moisture Analyzer

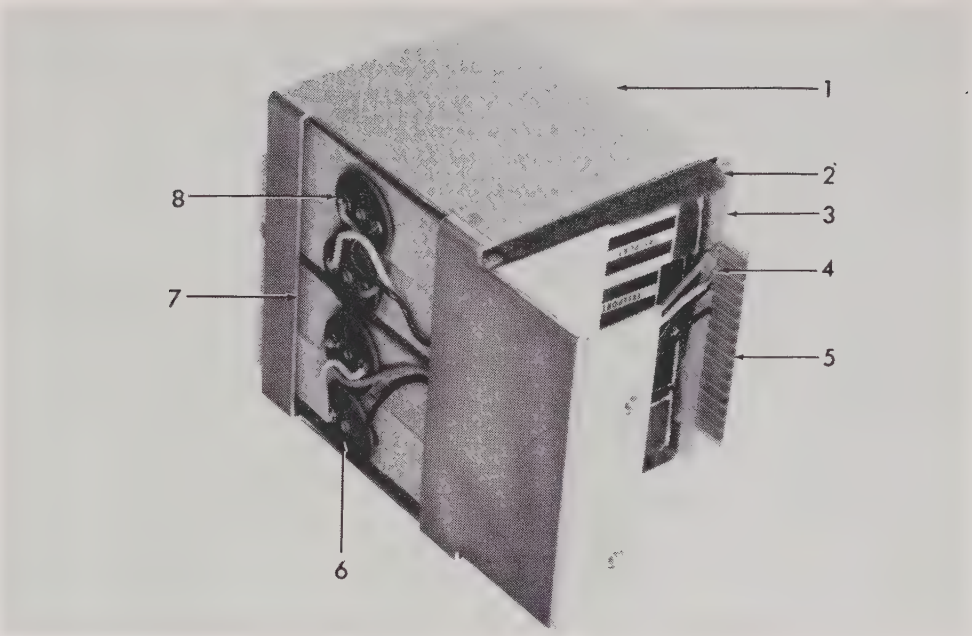




REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		194725	Holder, Cell	
2		193190	Cell, Trace Moisture	
3		193146	Manifold Assy	
			Attaching Parts:	
		809917	Screw, Pan Head, 6-32 x 5/16	(2)
		808266	Washer, Split, No. 6	(2)
4		193124	Bracket, Manifold	
			Attaching Parts:	
		809943	Screw, Pan Head, 8-32 x 3/8	(2)
		808268	Washer, Split, No. 8	(2)
5		630190	Tubing, Outlet	
6		193137	Harness	
7	J1,2	823481	Connector	(2)
			Attaching Parts:	
		866016	Spacer, Threaded	(4)
		809892	Screw, Pan Head, 4-40 x 3/8	(8)
		808264	Washer, Split, No. 4	(8)
		811756	Washer, Flat, No. 4	(4)
8	S1	193155	Switch, Attenuator	
9		193151	Bracket, Support	
			Attaching Parts:	
		809943	Screw, Pan Head, 8-32 x 3/8	
		808268	Washer, Split, No. 8	
10				
11		193141	Panel, Marked	
12		193195	Pin, Contact	(2)
			Attaching Parts:	
		193196	Insulator, Contact	(4)
		808594	Nut, Hex, 4-40	(2)
13		193114	Panel, Welded - Front	
			Attaching Parts:	
		812134	Screw, Flat Head, 8-32 x 1/4	(2)
		809943	Screw, Pan Head, 8-32 x 3/8	(2)
		808268	Washer, Split, No. 8	(2)
		802137	Washer, Flat, No. 8	(2)

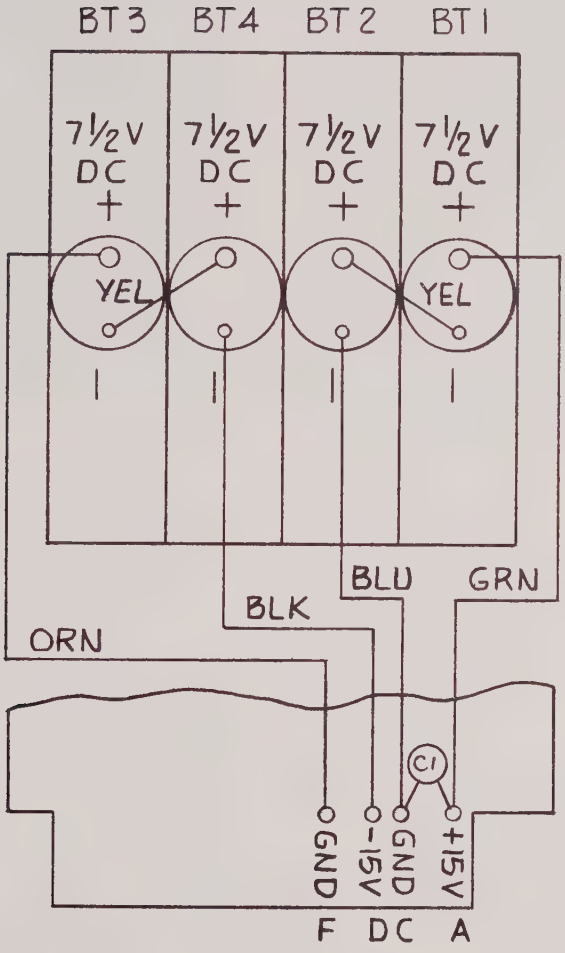
193006 Trace Moisture Analyzer, Portable D.C.

Figure 10-22. (2 of 2)



REF NO.	CIR REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		193133	Bracket, Support	
2		193148	Insulation, Battery	(3)
3		193147	Insulation, Battery	
4	C1	836864	Capacitor, .01 MFD, 50 V	
5		193132	Board, Printed Wiring	
			Attaching Parts:	
		809917	Screw, Pan Head, 6-32 x 5/16	(4)
		808266	Washer, Split, No. 6	(4)
		810690	Washer, Flat, No. 6	(4)
6		193140	Plug Assy, Battery	
7	BT1, 2,3,4	800428	Battery, 7 1/2 Volts	(4)
8		193139	Plug Assy, Battery	

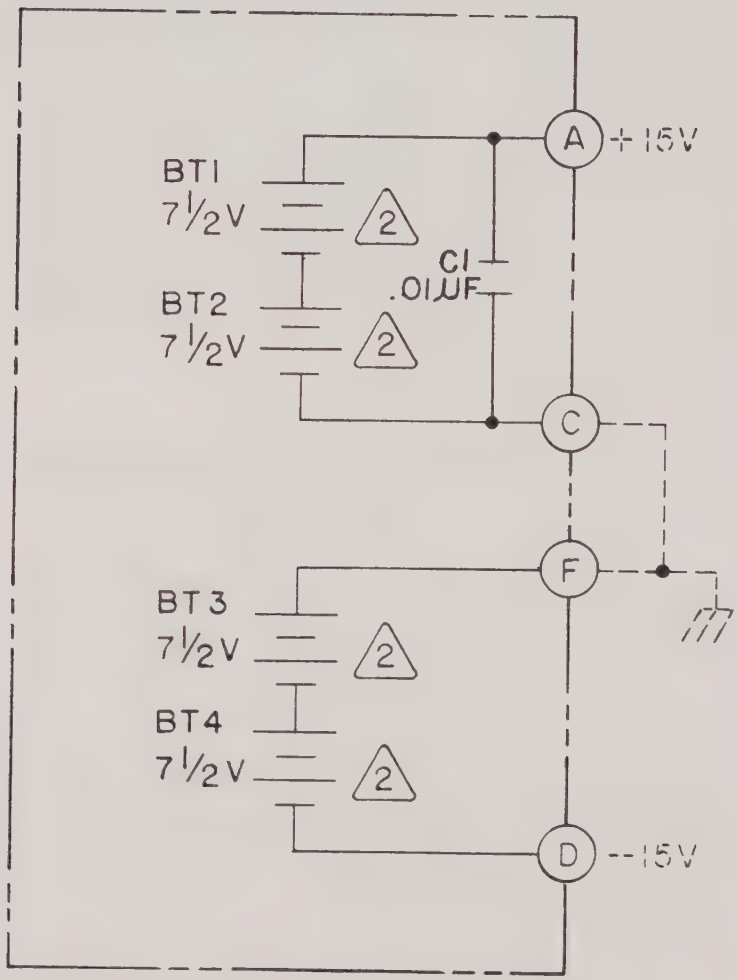
Figure 10-23. 194771 Battery Pack Assembly



194771 Battery Pack Assembly

Figure 10-23. (2 of 2)

BATTERY PACK ASSY
194771



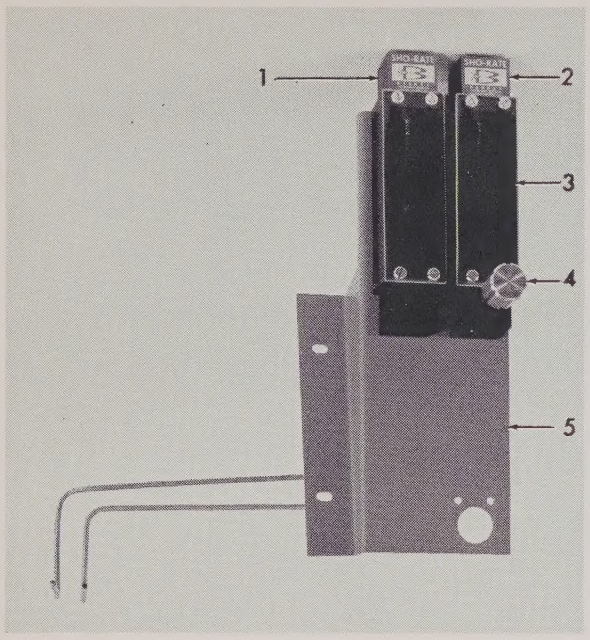
2 BATTERIES ARE 7 1/2 V D.C. BURGESS NO. B5.

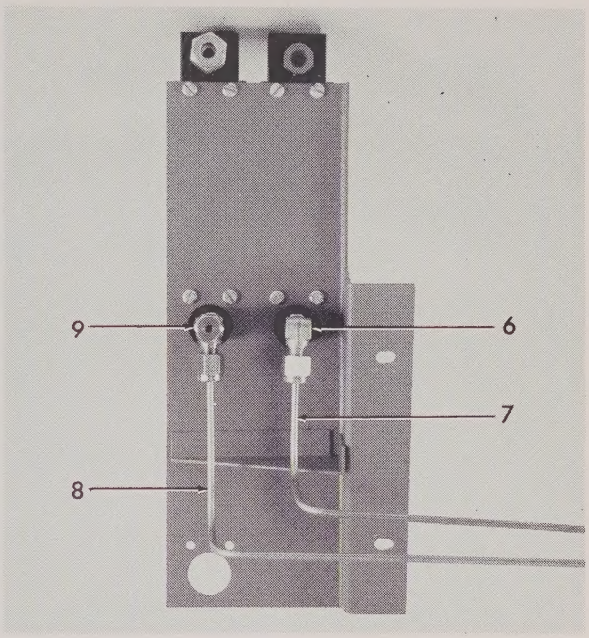
NOTES:

1. ALL VOLTAGE READINGS TAKEN IN REFERENCE TO GROUND.

194771 Battery Pack Assembly

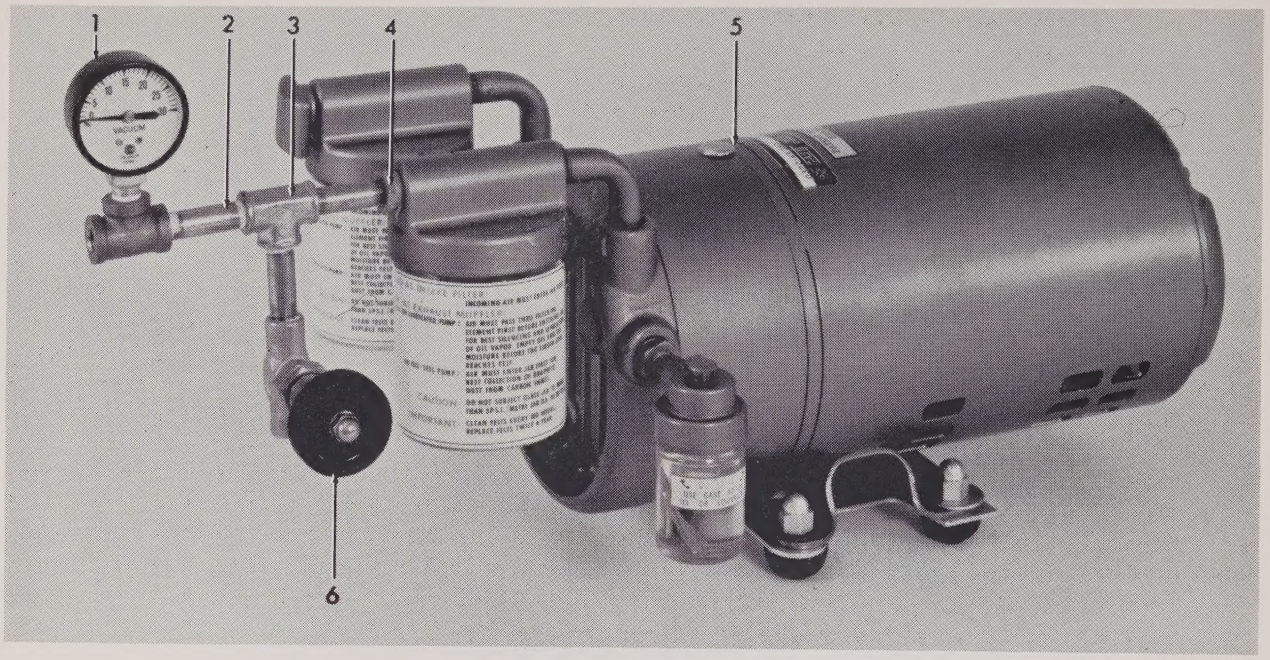
Figure 10-23. (3 of 3)





REF CIR NO.	REF	BECKMAN PART NO.	DESCRIPTION	QTY
1		810062	Flowmeter	
			Attaching Parts:	
		816060	Screw, Pan Head, 6-32 x 3/16	(4)
		808266	Washer, Split, No. 6	(4)
2		23381	Flowmeter	
			Attaching Parts:	
		816060	Screw, Pan Head, 6-32 x 3/16	(4)
		808266	Washer, Split, No. 6	(4)
3		25033	Window	(2)
			Attaching Part:	
		816060	Screw, Pan Head, 6-32 x 3/16	(8)
4		23377	Knob	
			Attaching Part:	
		71930	Bushing, Knob	
5		193173	Bracket	
6		16488	Fitting, Elbow	
7		630192	Tube, Outlet	
8		630193	Tube, Inlet	
9		810156	Fitting, Tee	

Figure 10-24. 194772 Flowmeter Accessory



REF CIR NO. REF	BECKMAN PART NO.	DESCRIPTION	60 HZ 630600	50 HZ 630601
1	815631	Gauge, Pressure	1	1
2	64409	Fitting, Nipple - 1/8 NPT	3	3
3	5016	Fitting, Tee - 1/8 FPT	2	2
4	599	Fitting, Adaptor, 1/4 x 1/8 NPT	1	1
5	866492	Pump, Vacuum - 60 Hz	1	0
	866493	Pump, Vacuum - 50 Hz	0	1
6	836241	Valve, Needle	1	1

Figure 10-25. 630600 and 630601 Pump Accessories

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